U.S. Department of Energy
Office of River Protection
Contract Management Division
Mr. Michael K. Barrett
Contracting Officer
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

CCN: 038773

Dear Mr. Barrett:

CONTRACT NO. DE-AC27-01RV14136 – AUTHORIZATION BASIS CHANGE NOTICE 24590-WTP-ABCN-ESH-02-023, REVISION 0, MODIFICATION OF THE RADIOLOGICAL EXPOSURE STANDARDS

Bechtel National, Inc. is submitting Authorization Basis Change Notice (ABCN) 24590-WTP-ABCN-ESH-02-023, Revision 0, to the U.S. Department of Energy, Office of River Protection and the Office of Safety Regulation (OSR) for approval (attached). This ABCN requests approval to modify the radiological exposure standards. Specifically, it proposes to change 25 rem/event to 100 rem/event for the facility and co-located workers in the extreme unlikely category of Table 1, SRD Safety Criterion 2.0-1.

Approval of this ABCN is requested within 30 days.

An electronic copy of ABCN 24590-WTP-ABCN-ESH-02-023, Revision 0, is provided for the OSR's information and use.

Very truly yours,

A. R. Veirup
Prime Contract Manager

LD/slr

Attachment: Authorization Basis Change Notice, 24590-WTP-ABCN-ESH-02-023, Revision 0, plus attachments

Authorization Basis Change Notice

ABCN Number 24590-WTP-ABCN-ESH-02-023 Revision 0

ABCN Title Modification of the Radiological Exposure Standards

I. ABCN Review and Approval Signatures

A. ABCN Preparation

	Print/Type Name	Signature	Date
Preparer:	Richard I. Smith		
Reviewer:	Lee Dougherty		

B. Required Reviewers

Review Required? *For each person checked, that signature block must be completed.*

Review Required?	Role	Print/Type Name	Signature	Date
☒	ES&H Manager	Fred Beranek		
☒	QA Manager	George Shell		
☒	PSC Chair	Bill Poulson		
☐	Commissioning/Training Manager			
☒	Engineering Manager	Fred Marsh		
☐	Construction Manager			
☐	Area Project Manager			
☐	Research & Technology Manager			
☒	PMT Chair	Dennis Klein		
☒	Other Affected Organization	Ken Gibson		
☒	Other Affected Organization	Rodger Dickey		
☐	Other Affected Organization			

C. ABCN Approval

	Print/Type Name	Signature	Date
WTP Project Manager	Ron Naventi		

ABCN Number 24590-WTP-ABCN-ESH-02-023 Revision 0

ABCN Title Modification of the Radiological Exposure Standards

II. Description of the Proposed Change to the Authorization Basis

D. Affected AB Documents:

Title	Document Number	Revision
Safety Requirements Document, Volume II	24590-WTP-SRD-ESH-01-001-02	1
Integrated Safety Management Plan	24590-WTP-ISMP-ESH-01-001	1

Decision to Deviate ☐ Yes ☒ No

If yes, DTD Number/Revision ________ DTD Closure Date:

Initiating Document Number/Revision ________ ________

E. Describe the proposed changes to the Authorization Basis Documents:

This proposed change to the SRD modifies SRD SC 2.0-1. Specifically it changes 25 rem/event to 100 rem/event for the facility and co-located workers in the extremely unlikely category of SRD Table 2-1, Radiological Exposure Standards. This ABCN also proposes changes to the relative corresponding text in SRD Appendix A, SRD Appendix D, and the ISMP Sections 1.3.7, 1.3.8, and Chapter 13.

In addition, an editorial correction is proposed to SRD figure Appendix D-1, Location of Facility and Collocated Workers. The Western boundary should follow highway 240 as it does in SRD figure Appendix D-2. Similar figures in ISMP Section 1 (Fig 1-2 and 1-3) are also proposed to be corrected.

The following attachments provide detailed description of the proposed changes.

Attachment 1, *Proposed Changes to the SRD*

Attachment 2, *Proposed Changes to the ISMP*

Attachment 3, *Summary of ISM Process for Revision to Implementing Standards and Safety Criteria*

Implementation of this change does not cause an impact to project design or programs.

F. List associated ABCNs and AB documents, if any:

No associated ABCNs or AB documents are impacted by the ABCN. The other AB documents (RPP, ISAR, QAM, and HAR) are not impacted. The methodology section of the PSAR for PCAR and PSAR for CAR (PSAR General Information Volume 1, Chapter 3) will require revision once this ABCN is approved (part of the implementation plan for the change).

No ABCNs currently approved by the project and anticipated to be approved by OSR affect this ABCN.

G. Explain why the change is needed:

The proposed change to the radiological exposure standards provides better consistency between the WTP Project and other sites in the DOE Complex (including the Hanford Site) with regard to the radiological exposure standards for workers under accident conditions.

The proposed change to the figures in SRD Appendix D and ISMP Section 1 is to show the correct figure consistently throughout the AB and is editorial in nature.

H. List the implementation activities and the projected completion dates:

Activity	Date
Inform DOE that AB has been revised and formally transmit electronic version	30 days or less after DOE

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ABCN Title Modification of the Radiological Exposure Standards

H. List the implementation activities and the projected completion dates:

Activity	**Date**
	approval
Distribute revised controlled copy pages / update WTP Library	30 days after DOE approval
Revise the following implementing documents:	

Documents	**Describe extent of revisions**	**Date**
1 Implementing procedures, associated guides, and training	Update the procedures, guides, and training to be consistent with the changes	30 days after DOE approval

Describe other activities:	**Date**
1 Revise the PSAR Volume I, General Information, Chapter 3.	ECD 9/26/02
Revise facility specific PSAR volumes.	Phased beginning 9/26/02

III. Evaluation of the Proposed Change

I. Is DOE approval required? Answer questions for Administrative Control changes OR Facility changes, not both.

For an Administrative Control change: **Yes** **No**

1. Does the revision involve the deletion or modification of a standard previously identified or established in the SRD? ☒ Yes ☐ No

   Explain:

   In SRD SC 2.0-1, the radiological exposure standard for facility and co-located workers for extremely unlikely events is changed from 25 rem/event to 100 rem/event. Corresponding text in SRD Appendices A and D and in the ISMP is also changed accordingly.

2. Does the revision result in a reduction in commitment currently described in the AB? ☒ Yes ☐ No

   Explain:

   The radiological exposure standards for facility and co-located workers for extremely unlikely events currently described and committed to in the SRD are proposed to be increased. This represents a reduction in commitment to the lower exposure standard.

3. Does the revision result in a reduction in the effectiveness of any procedure, program, or plan described in the AB? ☐ Yes ☒ No

   Explain:

   The change is limited to the changes to the AB documents as addressed above and does not reduce prior effectiveness.

For a Facility (technical) change: **Yes** **No**

1. Does the revision involve the deletion or modification of a standard previously identified or established in the SRD? ☐ Yes ☐ No

   Explain:

   N/A– Authorization Basis document revision proposed

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2. Does the revision create a new Design Basis Event (DBE)? ☐ ☐

   Explain:

   N/A– Authorization Basis document revision proposed

3. Does the revision result in the more than a minimal increase in the frequency or consequence of an analyzed DBE as described in the Safety Analysis Report? ☐ ☐

   Explain:

   N/A– Authorization Basis document revision proposed

4. Does the revision result in more than a minimal decrease in the Safety Functions of important-to-safety SSCs or change how a Safety Design Class SSC meets its respective safety function? ☐ ☐

   Explain:

   N/A– Authorization Basis document revision proposed

J. Complete the safety evaluation by describing how the revision to the AB:

1. will continue to comply with all applicable laws and regulations (e.g., 10 CFR 830, 10 CFR 835), conform to top-level safety standards (e.g., DOE/RL-96-0006), and provide adequate safety.

   The proposed change to the Radiological Exposure Standards (RES) table does not impact compliance with either applicable laws and regulations or the top-level safety standards. Applicable laws and regulations do not specify worker radiological exposure standards for accidents. The current 25 rem worker radiological exposure standard was derived by the prior WTP contractor as required by Table 1 of DOE/RL-96-0006. The current revision of DOE/RL-96-0006 recognizes, in a footnote to Table 1, the origin of the 25 rem standard and notes that this value is subject to modification through the RL/REG-97-13 process.

   Attachment 3 to this ABCN provides additional discussion of the safety evaluation conducted on these proposed changes.

2. will continue to conform to the contract requirements associated with the authorization basis document(s) affected by the revision.

   The contractual requirements associated with the SRD and ISMP, including compliance with the Radiological Exposure Standards defined within DOE/RL-96-0006 and selecting standards by a process that complies with DOE/RL-96-0004, remain a part of the AB.

3. will not result in inconsistencies with other commitments and descriptions contained in portions of the authorization basis or an authorization agreement not being revised.

   The revision to the radiological exposure standards table in SRD SC 2.0-1 will require a change to PSAR General Information Volume I, Chapter 3, Methodology. This change is part of the implementation plan for this ABCN.

   The proposed changes do not relate to fundamental aspects of design as described in the ISAR nor to a new or significant bounding hazard not identified in the HAR. Neither the RPP nor 10 CFR 835 address accident exposure limits for workers; therefore, the proposed changes are consistent with the RPP and do not propose changes relative to the implementation of 10 CFR 835.

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ABCN Title Modification of the Radiological Exposure Standards

K. Justification of the Proposed Change

If the change requires DOE approval, provide a justification that demonstrates that the proposed change is safe.
The proposed change to the facility and co-located worker radiological exposure standard for extremely unlikely events is justified based on the following:

- An acute radiation dose of approximately 100 rem carries almost no risk of prompt death per RL/REG-97-09, *Guidance for Review of TWRS Privatization Contractor Radiation Exposure Standards for Workers*.
- The use of a 100 rem standard for very low frequency events does not compromise worker safety.
- The change makes WTP more consistent with the approach employed elsewhere in the DOE complex including the safety criteria established for the Hanford Site by DOE (Klein 2002 referenced in attachment 3 to this ABCN).
- The WTP risk goals are maintained.
- The revised derived values in the RES table are not significant to the overall risk of the workers as discussed above. The continued use of engineered safety features and administrative controls to ensure high consequence events remain at an extremely low frequency will continue to ensure an adequate safety basis for the WTP.

Attachment 3 to this ABCN provides additional discussion on the justification that demonstrates that the proposed changes are safe.

L. Certification of Continued SRD Adequacy

Based on evaluations from III.I, if either question III.I.1 is marked "Yes", Project Manager certification is required. The Project Manager's signature certifies that the revised SRD continues to identify a set of standards that provides adequate safety, complies with WTP applicable laws and regulations, and conforms with top-level safety standards and principles. This certification is based on adherence to the DOE/RL-96-0004 standards identification process and successful completion of review and confirmation by the PSC.

WTP Project Manager:	Ron Naventi		
	Print/Type Name	*Signature*	*Date*

M. List of Attachments

1. Attachment 1, *Proposed Changes to the SRD*
2. Attachment 2, *Proposed Changes to the ISMP*
3. Attachment 3, *Summary of ISM Process for Revision to Implementing Standards and Safety Criteria*

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Attachment 1

Proposed Changes to the *Safety Requirements Document*

Document Part	Title	Starting Page	No. of Pages
Section 2.0	Radiological and Process Standards	2-1	3
Appendix A	Implementing Standard for Safety Standards and Requirements Identification	A-i	19
Appendix D	Radiological Exposure Standards for the WTP Project	D-i	13

# of pages (including cover sheet): 36

2.0 Radiological and Process Standards

Safety Criterion: 2.0 - 1

The following Radiological Dose Standards shall be applied to protect the public and workers from WTP radiological hazards.

Table 2-1. Radiological Exposure Standards Above Normal Background

Description	Estimated Frequency of Occurrence f (yr^{-1})	General Guidelines	Worker	Collocated Worker	Public
Normal Events Events that occur regularly in the course of facility operation (e.g., normal facility operations); including routine and preventive maintenance activities.	>0.1	Normal modes of operating facility systems should provide adequate protection of health and safety.	≤5 rem/yr ≤50 rem/yr any organ, skin, or extremity ≤15 rem/yr lens of eye ≤1.0 rem/yr ALARA design objective per 10CFR835.1002(b)[(1)]	≤5 rem/yr ≤1.0 rem/yr ALARA design objective per 10 CFR 835.1002(b)[(1)]	≤10 mrem/yr (airborne pathway) ≤100 mrem/yr (all sources) ≤100 mrem/yr (public in the controlled area) ≤25 mrem/yr (radioactive waste)
Anticipated Events Events of moderate frequency that may occur once or more during the life of a facility (e.g., minor incidents and upsets).	$10^{-2}<f\leq10^{-1}$	The facility should be capable of returning to operation without extensive corrective action or repair.	≤5 rem/event [(2,3)] 1.0 rem/event design action threshold [(4)]	≤5 rem/event (2, 3) 1.0 rem/event design action threshold[(4)]	≤100 mrem/event[(3)]
Unlikely Events Events that are not expected, but may occur during the lifetime of a facility (e.g., more severe incidents).	$10^{-4}<f\leq10^{-2}$	The facility should be capable of returning to operation following potentially extensive corrective action or repair, as necessary.	≤25 rem/event[(2,3)]	≤25 rem/event[(2, 3)]	≤5 rem/event[(3)]

Table 2-1. Radiological Exposure Standards Above Normal Background

Description	Estimated Frequency of Occurrence f (yr^{-1})	General Guidelines	Worker	Collocated Worker	Public
Extremely Unlikely Events Events that are not expected to occur during the life of the facility but are postulated because their consequences would include the potential for the release of significant amounts of radioactive material.	$10^{-6}<f\leq 10^{-4}$	Facility damage may preclude returning to operation.	≤~~25~~ 100 rem/event$^{(2,3)}$	≤~~25~~ 100 rem/event$^{(2,3)}$	≤25 rem/event ≤5 rem/event target$^{(3)}$ ≤300 rem/event to thyroid
Location of Receptor			Within the WTP Controlled Area Boundary	The most limiting location at or beyond the WTP Controlled Area Boundary	The most limiting location along the near river bank/ Hwy240/ southern boundary

Notes

(1) In addition to meeting the listed design objective of 10 CFR 835.1002(b), the inhalation of radioactive material by workers and collocated workers under normal conditions is kept ALARA through the control of airborne radioactivity as described in 10 CFR 835.1002(c).

(2) In addition to meeting the listed worker and collocated worker exposure standards for accidents, the Worker Accident Risk Goal is satisfied through the calculation of the risk from accidents with accident prevention and mitigation features added as necessary to meet the Goal.

(3) In addition to meeting the listed exposure standards for accidents, the approach to accident mitigation is to evaluate accident consequences to ensure that the calculated exposures are far enough below standards to account for uncertainties in the analysis, and to provide for sufficient design margin and operational flexibility.

(4) When a calculated accident exposure exceeds this threshold, then appropriate actions are taken. These include carrying out a less bounding (i.e., more realistic) evaluation to show that the accident consequences will be below the threshold or evaluating additional safeguards for cost-effectiveness and/or feasibility. This threshold is not a limit; it does not require the implementation of additional preventative or mitigative features if they are not both cost-effective and feasible.

Implementing Codes and Standards

24590-WTP-SRD-ESH-01-001-02, *Safety Requirements Document Volume II*

Appendix A, "Implementing Standard for Safety Standards and Requirements Identification"

Appendix D, "Radiological Exposure Standards for the WTP Project"

Regulatory Basis

DOE/RL-96-0006 *2.1* *Individual (Dose Standards Above Normal Background)*

Safety Criterion: 2.0 - 2

The following dose standards shall be applied to protect the public and workers from WTP chemical hazards.

Releases exposing the offsite public to 2001 American Industrial Hygiene Association (AIHA) Emergency Response Planning Guideline—2 (ERPG-2) concentrations.

Releases exposing the co-located worker to 2001 AIHA ERPG-3 concentrations.

Accidents affecting the facility worker that could cause in-patient hospitalization of at least 3 facility workers, or at least a single fatality.

Where ERPG values have not been published, the 2001 DOE Temporary Emergency Exposure Limits (TEELs) Revision 17m shall be used as substitute ERPGs.

Implementing Codes and Standards

24590-WTP-SRD-ESH-01-001-02, *Safety Requirements Document Volume II*
Appendix A, "Implementing Standard for Safety Standards and Requirements Identification"

Safety Criterion: 2.0 - 3

In addition to the dose limits specified for the public in Safety Criterion 2.0-1 Table 2-1, the dose in any unrestricted area from external sources shall not exceed 0.002 rem in any one hour.

Implementing Codes and Standards

DOE G 441.1-2, *Occupational ALARA Program Guide*

Regulatory Basis

WAC 246-221 Radiation Protection Standards Location: 060 (1)
WAC 246-247 Radiation Protection - Air Emissions Location: Part 040 (2)

Appendix A

Implementing Standard for Safety Standards and Requirements Identification

CONTENTS

1.0 Introduction

This standard implements the process for establishing a set of radiological, nuclear, and process safety requirements and standards as described in DOE/RL-96-0004 and RL/REG-98-17. The Project refers to this process as Integrated Safety Management (ISM).

The activities described below establish radiological, nuclear and process safety standards and requirements for design, construction, and operation of the facility. Establishment of safety standards and requirements is an iterative process that takes place throughout the life of the project. As the design evolves, the process repeatedly evaluates these standards and requirements based on the evolving design.

The Safety Requirements Document (SRD) provides formal documentation of the standards, which are a result of this process. The SRD is updated as required to reflect the results of successive iterations of the standards and requirements identification process (i.e., the ISM process).

2.0 Process Initiation

The RPP-WTP Project Manager shall ensure implementation of the Project Management Plan, thus assuring that adequate resources with appropriate technical background are available and organized to perform subsequent tasks. This activity also assures that the input information required for the safety standards and requirements identification process has been collected and organized. This input information includes the top-level safety standards and principles stipulated by DOE in DOE/RL-96-0006 and the laws and regulations applicable to the RPP-WTP project.

The DOE/RL-96-0004 safety requirements and standards identification Process Manager for the project is the Radiological, Nuclear, and Process Safety Manager.

The Process Manager chairs the DOE/RL-96-0004 safety requirements and standards identification Process Management Team (PMT). The PMT is constituted in accordance with project implementing documents and includes managers from the following project organizations:

- Environmental, Safety, & Health
- Engineering
- Operations

The Process Management Team shall oversee the ISM process and shall provide resources and resolve issues as necessary. The PMT shall set up integrated teams for the conduct of ISM on a plant system basis. Individual PMT members shall provide various subject matter experts to help fulfill the roles required of the Integrated Teams for conduct of the ISM process.

3.0 Identification of Work

The aim of this activity is to describe the work that will be performed so that the hazards inherent in the work can be identified and evaluated. Work activity experts who have extensive knowledge of the overall processing approach and are integrally associated with the facility design shall perform this activity. work activity experts shall be drawn from the following RPP-WTP organizations:

- Engineering staff
- Operations staff

When appropriate, the PMT may also draw work activity experts from the staff of other departments, such as from Construction.

In an overall sense, identification of work involves definition of the project mission and identification of the processes that must be performed to accomplish the mission. It includes selection of optimum functions, processes, and parameters through trade studies and definition of functional requirements. Identification of work for the purpose of design development involves definition of various plant systems, structures, and components. This latter definition is the focus for the Integrated Teams created to conduct ISM on a plant system basis.

The product of this activity includes:

- Process description
- System descriptions
- Descriptions of key structures
- Basis of design documents
- PFDs, MFDs, and P&IDs

The results of the identification of work activity shall be documented in the SRD by inclusion or by reference.

The identification of work activity is an iterative process. Identification of work will be reconsidered in light of design evolution, the outcome of hazard evaluations, and the development of hazard control strategies.

4.0 Hazard Evaluation

The aim of the hazard evaluation activity is to identify and characterize the hazards resulting from the work. The integrated teams shall conduct the hazard evaluation activity on a plant system basis. These teams shall include work activity experts (as defined in section 3.0), hazard assessment experts, and hazard control experts.

Hazard assessment experts and hazard control experts shall generally be members of the technical staffs of the Safety Analysis Manager and of the Regulatory Safety Manager. The process management team shall provide additional technical resources as required to evaluate the hazards.

The hazard evaluation shall address hazards inherent in normal operation as well as potential accidents resulting from abnormal internal and external events.

The hazard evaluation shall comprise the following elements:

- Identification of Hazards
- Identification of Potential Accident/Event Sequences
- Estimation of Accident Consequences
- Estimation of Accident Frequencies
- Consideration of Common Cause and Common Mode Failures
- Definition of Design Basis Events
- Definition of Operating Environment
- Identification of Potential Control Strategies
- Documentation

These elements are discussed below.

4.1 Identification of Hazards

The objective of this element is to systematically identify the hazards associated with the defined work.

The integrated teams shall compile a list of hazardous materials and energy sources associated with the facility processes, design, and operations. This list shall be compiled based on the identified work. This compilation provides information used to identify potential accidents resulting in the uncontrolled release of hazardous material or energy to workers, the public, and the environment. The team may use checklists to guide the compilation process and to assure that all potential hazards from both natural and manmade sources originating from outside and inside the facility are addressed.

4.2 Identification of Potential Accident/Event Sequences

The objective of this element is to perform a structured and systematic examination of the facility and its operations to identify potential accidents (including common mode and common cause failures). The team shall conduct this examination using methodologies and guidelines in AIChE (1992).

4.3 Estimation of Consequences

4.3.1 Accident Severity Level Identification

A severity level, SL, shall be assigned to each postulated radiological accident. The severity level shall reflect the unmitigated consequences of the postulated accident. Unmitigated consequences shall account for the quantity, form and location of the radioactive material available for release, and the energy sources available to interact with the hazardous material. Unmitigated consequences shall not account SSCs that serve to prevent or mitigate the release. Specifically, unmitigated consequences shall be evaluated on the basis of a ground level release. The severity level shall be defined as follows:

SL	Facility Worker Consequence	Collocated Worker Consequence	Public Consequence
SL-1	> ~~25~~ 100 rem/event	> ~~25~~ 100 rem/event	> 5 rem/event
SL-2	5 - ~~25~~ 100 rem/event	5 - ~~25~~ 100 rem/event	1 - 5 rem/event
SL-3	1 - 5 rem/event	1 - 5 rem/event	0.1 - 1 rem/event
SL-4	< 1 rem/event	< 1 rem/event	< 0.1 rem/event

These severity levels are related to the radiological and process standards of SRD Chapter 2.0 as follows:

- The unmitigated consequences associated with SL-1 events exceed the radiological standards for extremely unlikely events (SRD Safety Criterion 2.0-1).
- The unmitigated consequences associated with SL-2 events are below the radiological standards for extremely unlikely events (SRD Safety Criterion 2.0-1).
- The unmitigated consequences associated with SL-3 events are below the radiological standards for unlikely events (SRD Safety Criterion 2.0-1).
- The unmitigated consequences associated with SL-4 events are below the radiological standards for anticipated events (SRD Safety Criterion 2.0-1).

Consequences to the facility worker shall be evaluated at the worst-case occupied location. Consequences to the collocated worker and the public shall be evaluated at the locations specified in Appendix D to the *Safety Requirements Document, Volume II*.

Early in the design, the severity level is estimated based on the experience of the Integrated Teams. As the design progresses, these estimates are confirmed through the formal accident analyses described in section 4.3.2. These accident analyses do not address all of the potential accidents identified, but they do address bounding examples of each type of accident. The team should use the results of the accident analyses to validate the severity level estimates for potential accidents not addressed in the formal accident analyses.

The potential consequences of releases of hazardous chemicals shall also be assessed. The assessment shall consider both the inherent hazard of the chemical itself, and the potential for the chemical hazard to initiate or exacerbate a radiological hazard.

4.3.2 Accident Analysis

Accident analyses provide confirmation that the design satisfies the radiological and process standards in the SRD. Accident analyses also provide confirmation of the severity levels assigned to potential accidents.

The formal accident analyses shall address design basis external events and natural phenomena as well as postulated internal events.

The postulated internal events shall be grouped by type. Accident types applicable to the RPP-WTP include the following:

- Liquid spills
- Spills of solid materials
- Pressurized releases
- Chemical reactions
- Boiling
- Flammable gas ignition (e.g., hydrogen in air)
- Fires
- Load drops
- Radiation exposure
- Criticality

As a minimum, the accident analysis shall address the most severe credible event of each type.

Initially, the accident analysis shall evaluate the unmitigated consequences of the postulated accidents. As control strategies are developed, the accident analysis shall also evaluate the impact of the SSCs that implement the control strategy on the potential consequences.

The accident analysis shall consider the following factors:

- Inventory of material at risk in the scenario.
- The respirable release fraction for the accident scenario. This is a function of the composition of the material at risk, of the form of the material, and of the interaction between the material at risk and the energy available in the accident scenario.
- The fraction of the airborne material released to potentially occupied locations or the environment.
- Bounding atmospheric dispersion coefficients (if appropriate).
- Radiological composition of the material released.
- External radiation field.
- Exposure times.

The accident analysis shall address the potential consequence to facility workers, collocated workers, and the public.

4.3.3 Normal Conditions

Some hazards inherent in normal operation must be mitigated to comply with the standards for normal operation in SRD Chapter 2.0. Such hazards shall be addressed in accordance with the RPP-WTP Radiation Protection Plan.

4.4 Estimation of Accident Frequencies

There is normally insufficient information early in the design to accurately quantify the frequency of postulated internal events because this frequency depends on the design of the SSCs that implement the control strategy used to manage the hazard. At an early stage, frequency evaluations may be based on the team's experience with similar hazards in similar facilities. The team shall validate these estimates as the design develops.

As the design matures, information on the frequency of hazardous events is gained from the use of hazard evaluation techniques that provide frequency data (i.e., HAZOP, FMEA, Event Trees, and Fault Trees). Evaluations of the frequency of failure in redundant systems or in diverse systems using similar equipment shall consider dependent failures.

The frequencies of design basis external events may be derived from existing analyses (e.g., safety analyses for adjacent facilities), from evaluation of historical data (e.g., transportation data), or from site-specific information (e.g., seismic history).

4.5 Consideration of Common Cause/Common Mode failures

The following are typical common cause events:

- Natural phenomena events
- External man made events
- Loss of electrical power
- Fire
- Internal missiles
- Internal flooding

Common cause events should be treated as discrete events in the hazard analysis. The analyses of common cause events shall focus on identifying provisions to prevent the loss of safety function. The analyses of natural phenomena events shall consider induced effects, such as fire and loss of electrical power.

Common mode failures shall be addressed through dependent failure modeling as required by section 4.4 above.

4.6 Definition of Design Basis Events

The hazard evaluation shall identify a set of internal design basis events. These events shall be selected to define a set of bounding performance requirements for the SSCs relied upon to control the hazards.

The hazard evaluation shall define a set of external man made design basis events. These events shall be selected based on the results of the hazard analysis to define a set of bounding performance requirements for the SSCs relied upon to mitigate these events.

The integrated teams perform the identification of internal and external design basis events.

Design basis natural phenomena shall be as defined in the SRD Safety Criteria 4.1-3 and 4.1-4.

4.7 Definition of Operating Environment

The hazard evaluation shall define a set of bounding operating conditions in which SSCs relied upon to control hazards must function. Environmental parameters to be addressed include the following:

- Temperature
- Pressure
- Humidity
- Radiation Levels
- Chemical Environment

4.8 Identification of Potential Controls

Based on the experience and judgement of team members, the integrated team shall identify an initial set of potential hazard controls to manage each potential accident. This set of potential hazard controls shall address means of preventing the potential accident and should address means of mitigating the consequences of the accident. The function(s) of each potential hazard control should be clearly described. Potential hazard controls shall be identified to manage accident conditions arising from upsets in the process, conditions arising from external events, and conditions inherent in the normal operation of the process.

4.9 Documentation

The hazard evaluation shall be documented in a hazard analysis report (HAR). The results of the hazard evaluation shall be contained in a hazard database. For each hazard considered, the hazard database shall record the following information produced by the hazard evaluation:

- Hazard identifier
- Hazard description
- Initiators
- Hazard severity level estimate (based on unmitigated consequences)

- Severity level basis
- Assumptions affecting the release (material at risk, energy available, etc)
- Hazard frequency estimate
- Basis for frequency estimate
- Potential controls and functions
- References for the hazard (these would typically be products of the work identification process)

Hazard evaluation documentation shall be included in the SRD by inclusion or by reference. This documentation shall include the following:

- Description of the comprehensive approach to hazard evaluation
- Description of the methodology for identification and quantification of work hazards
- Description of the methodology for identifying potential accident scenarios
- Description of the methodology for consequence assessment
- Clear identification of assumptions (e.g., quantity and form of material at risk, rate of release and relevant process conditions) that may drive or inhibit the potential accident must be clearly identified
- Description of results
- Evidence of appropriate staffing, and adequate technical staffing and structure applied to the hazard evaluation

5.0 Development of Control Strategies

The aim of the development of control strategies activity is to identify a means of controlling each of the hazards identified in the hazard evaluation. The integrated teams of work activity experts, hazard assessment experts, and hazard control experts, as discussed in sections 3.0 and 4.0, perform this activity.

The PMT members shall provide additional technical resources as required to develop the control strategies.

The integrated teams select preferred control strategies based on the set of potential controls identified by the hazard evaluation team. Selection of the preferred strategy considers the following factors:

- The functions required of the strategy in order to control the hazard
- The degree of defense in depth and reliability provided by the control strategy. The Implementing Standard for Defense in Depth provides guidance in this area.
- Applicable design basis events.
- The operating environment in which the SSCs implementing the control strategy must function.
- Effectiveness and efficiency of the control strategy.
- Conformance with the DOE stipulated top level standards.
- Compliance with applicable laws and regulations.

The control strategy will typically comprise a series of elements including some or all of the following:

- Passive and/or active SSCs that function to prevent the release (that is, SSCs that reduce the probability that a release will occur)
- Passive and/or active SSCs that function to mitigate the release (that is, SSCs that reduce the consequences once a release has occurred)
- Administrative controls (for example, limits on inventory)

Consistent with the defense in depth principle, the control strategy development should emphasize preventive measures. It should also emphasize passive SSCs over active SSCs and retention of released material over dispersion. Ideally, the preferred control strategy should incorporate SSCs that prevent releases and SSCs that mitigate the consequences of a release, should it occur.

Once the preferred control strategy is identified, it shall be evaluated using the techniques described in section 4.3 through 4.5. In addition, the evaluation of the control strategy shall identify the measures necessary to assure that it performs its functions reliably. Such measures include maintenance requirements, testing intervals and calibration frequency. The results of this evaluation serve to confirm that the control strategy is capable of satisfying SRD Safety Criteria 2.0-1.

If credit is taken for operator action to satisfy the public radiological exposure standards of Safety Criterion 2.0-1, adequate radiation protection is provided to permit access and occupancy of the control room or other control locations under accident conditions without personnel receiving radiation doses in excess of 5 rem total effective does equivalent (TEDE), 30 rem thyroid, and 30 rem beta skin for the duration of the accident. In the event operator action is not required, other than immediate actions required to place the facility operation into a safe state, then the worker exposure standards of Safety Criterion 2.0-1 apply. If credit is taken for operator action to satisfy public chemical exposure to the standards of Safety Criterion 2.0-2, provisions for operational access and control are made so that the operator exposure does not exceed the limits specified in Safety Criterion 4.3-7.

Documentation of the hazard control strategy development process shall clearly indicate selection of the control strategies and show the linkage of the control strategies to the respective hazards. The control strategy should be described in terms of the safety functions required (e.g., limit release of radionuclides, etc.) and in terms of a set of engineered features, administrative controls (procedures and training), and management systems selected for implementing the strategy. When the nature of the hazard is such that the appropriate control strategy is self-evident, the documentation need only demonstrate that the control strategy meets most, if not all, of the selection criteria, and need not provide a discussion of other, nonapplicable control strategies. Similarly, where a proven control strategy that is appropriate to the hazard exists and it is obvious to the team that there are no other alternative control strategies that could be equally attractive, then the documentation need only demonstrate that the control strategy meets most, if not all, of the selection criteria. Otherwise, the documentation should identify all control strategies considered and provide a defensible rationale for selection of the preferred strategy.

The following information produced by the control strategy definition shall be recorded in the hazard database:

- Preferred control strategy
- Linkage of the control strategy to the respective hazards
- Rationale for preferred control strategy selection
- Defense in depth provided
- Control strategy functions and performance requirements
- Estimate of the unmitigated event frequency
- Estimate of the consequences from the mitigated event
- Estimate of the mitigated event frequency
- Applicable design basis events (e.g., design basis earthquake)

One of the issues in developing a control strategy for a particular hazard is determining the number of layers of prevention and mitigation appropriate for the hazard. The control strategies shall conform to the requirements defined in the Implementing Standard for Defense in Depth. In addition, the following guidance shall be considered in developing control strategies.

The general RPP-WTP design approach is to provide two confinement barriers against the release of hazardous materials. The process vessels and piping form the primary confinement barrier; the process cells and associated ventilation system form the secondary confinement barrier. Releases from the primary confinement are mitigated by the secondary confinement.

The accident severity levels defined in section 4.3.1 are related to the exposure standards in SRD Safety Criterion 2.0-1. The SRD Safety Criterion 2.0-1 exposure standards are frequency based, so it is possible to establish target frequencies for events with a given severity level. The target frequencies tabulated below are consistent with SRD Safety Criterion 2.0-1.

SL	Event Target Frequency (yr^{-1})
SL-1	$<10^{-6}$
SL-2	$<10^{-4}$
SL-3	$<10^{-2}$
SL-4	$<10^{-1}$

These target frequencies may be used to guide control strategy development as described below.
For SL-1 events:

- Meeting the target frequency will usually require a control strategy that incorporates diverse and independent SSCs that act to prevent and mitigate the event.
- Meeting the target frequency will usually require diverse SSCs that act to prevent the release.

- The degree of mitigation required depends on the release frequency, that is, on the reliability of the preventive SSCs. For example, assume that the preventive SSCs assure that the frequency of release is less than 10^{-4} per year, but more than 10^{-6} per year. This frequency is not acceptable for events that have SL-1 level consequences, but is acceptable for events that have SL-2 level consequences. Therefore, the control strategy would need to provide enough mitigation to reduce the consequences of the release to the levels associated with a SL-2 event, as a minimum. The combined reliability of the preventive SSCs and the SSCs that provide mitigation needs to satisfy the target frequency for a SL-1 event. That is, the probability that the SSCs that provide mitigation will fail should be on the order of 10^{-2}, given the release.
- SSCs in control strategies for SL-1 events shall satisfy the single failure criteria in the Implementing Standard for Defense in Depth.

For SL-2 events:

- Meeting the target frequency will usually require a control strategy that incorporates diverse and independent SSCs that act to prevent and mitigate the event.
- The degree of mitigation required depends on the release frequency, that is, on the reliability of the preventive SSCs. For example, assume that the only viable preventive SSCs assure that the frequency of release is less than 10^{-2} per year, but more than 10^{-4} per year. This frequency is not acceptable for events that have SL-2 level consequences, but is acceptable for events that have SL-3 level consequences. Therefore, the control strategy would need to provide enough mitigation to reduce the consequences of the release to the levels associated with a SL-3 event, as a minimum. The combined reliability of the preventive SSCs and the SSCs that provide mitigation needs to satisfy the target frequency for a SL-2 event. That is, the probability that the SSCs that provide mitigation will fail should be on the order of 10^{-2}, given the release.
- SSCs in control strategies for SL-2 events should satisfy the single failure criteria in the Implementing Standard for Defense in Depth.

For SL-3 and SL-4 events:

- The mitigation provided by the secondary confinement would be adequate to satisfy SRD Safety Criterion 2.0-1. It would also be adequate to satisfy SRD Safety Criteria 1.0-3 through 1.0-5. However, preventive features should be considered consistent with the defense in depth principle.
- A single preventive SSC may satisfy the frequency goal for SL-3 and SL-4 events.
- SSCs in control strategies for SL-3 and SL-4 events need not satisfy the single failure criteria in the Implementing Standard for Defense in Depth.

Notwithstanding the foregoing guidance on control strategy selection, administrative controls alone may be credited as the controls that protect facility workers, when appropriate. Timely evacuation from the vicinity of the hazard is considered to be an administrative control.

6.0 Classification of Structures, Systems, and Components

The design classification process used on the RPP-WTP Project provides a consistent, project-wide approach for the classification of the RPP-WTP SSCs based on their importance to controlling normal releases and accident prevention and mitigation. This approach ensures that SSCs are designed, constructed, fabricated, installed, tested, operated, and maintained to quality standards commensurate with the importance of the functions that need to be performed. As the facility moves to deactivation, and the safety functions change, the classification of SSCs can be revised as necessary.

The RPP-WTP project has established a design classification system to provide assurance to DOE that the defined safety functions of SSCs will perform as intended.

SSCs defined as Important-to-Safety for the RPP-WTP include the following:

1) SSCs needed to prevent or mitigate accidents that could exceed public or worker radiological and chemical exposure standards of Safety Criteria 2.0-1 and 2.0-2 and SSCs needed to prevent criticality. This set of SSCs includes both the front line and support systems needed to meet these exposure standards or to prevent criticality. This set of Important-to-Safety SSCs are designated as Safety Design Class, as defined by SRD Safety Criterion 1.0-8.
2) SSCs needed to achieve compliance with the radiological or chemical exposure standards for the public and workers during normal operation; and SSCs that place frequent demands on, or adversely affect the function of, Safety Design Class SSCs if they fail or malfunction. This set of Important-to-Safety SSCs are designated as Safety Design Significant, as defined by SRD Safety Criterion 1.0-8.

   The processes for identifying the SSCs for each of the two groups of SSCs Important-to-Safety and the requirements assigned to each of the two groups are discussed below.

   Safety Design Class SSCs typically are identified by the results of accident analyses that show the potential for exposure standards to be exceeded or prevent a criticality. However, additional items may also be designated Safety Design Class independent of a specific accident analysis. These are items that protect the facility worker from potentially serious events. Typically, these events are deemed to present a challenge to the facility worker severe enough that mitigation is prudent, without the need to perform a specific consequence analysis.

   Safety Design Significant SSCs are identified in several ways including: (1) SSCs identified as significant contributors to safety by the analyses that confirm the facility accident risk goals are met (this is one way to identify SSCs that place frequent demands on, or adversely affect the function of, Safety Design Class SSCs if they fail or malfunction), (2) SSCs that are needed to ensure that standards for normal operation are not exceeded (e.g., bulk shield walls or radiation monitors), (3) SSCs selected based on the dictates of nuclear and chemical facility experience and prudent engineering practices, and (4) SSCs whose failure could prevent Safety Design Class SSCs from performing their safety function (e.g., Seismic II/I items).

When an SSC is designated as Safety Design Class it has the following attributes:

1) Quality Level 1 (QL-1) is applied to the SSC to provide added assurance that the SSCs can perform their specified safety function.

2) For an active system or component, the safety function is preserved by application of defense-in-depth such that failure of the system or component will not result in exceeding a public or worker accident exposure standard. For a mitigating feature, this means that, given that the accident has occurred, the consequence of the accident will not result in exceeding a public or worker exposure standard. For a preventative feature, this means that the failure of the system or component will not allow the accident to occur and progress such that a public or worker accident exposure standard is exceeded. If the hazard analysis shows that these requirements are necessary, this requirement may be achieved by designing the Safety Design Class system or component to withstand a single active failure or by designating two separate and independent systems or components as Safety Design Class.
3) The SSC is designed to withstand the effects of natural phenomena such that it can perform any safety functions required as a result of a natural phenomena event in accordance with Safety Criterion 4.1-3.
4) General design requirements are applied as identified in Chapter 4.0 of the SRD for Safety Design Class SSCs.
5) Specific design requirements based on the type of component are applied as invoked in SRD Chapter 4.0.
6) Other design requirements may be applied based on the specific safety function to be performed by the Safety Design Class SSC. This specific safety function is determined from the accident analysis that identified the need for prevention or mitigation by Safety Design Class SSCs.
7) Operational requirements (e.g., periodic testing and preventative maintenance) are applied to Safety Design Class SSCs through the application of Technical Safety Requirements.

When an SSC is classified as Safety Design Significant it is has the following attributes.

1) Quality Level 2 (QL-2) is applied to the SSC to provide added assurance that the SSCs can perform their specified safety function.
2) The SSC is designed to withstand the effects of natural phenomena such that it can perform its safety functions required as a result of a natural phenomena event in accordance with Safety Criterion 4.1-4.
3) General and specific design requirements are applied as identified in Chapter 4.0 of the SRD for Safety Design Significant SSCs.
4) Other design requirements again may be applied based on the specific safety function to be performed by the Safety Design Significant SSC.

7.0 Identification of Standards

Identification of standards is an iterative activity. Initially, the set of standards and requirements is derived from a general understanding of the hazards inherent in the work. As the design evolves, the hazard evaluation and the development of the control strategies justify tailoring the set of standards to better fit the hazards.

The identification of engineering/design, manufacture/fabrication, and construction standards is performed by an integrated team including work activity experts, hazard assessment experts, hazard control experts, as discussed in sections 3.0 and 4.0, and standards experts. Identification of other standards (e.g., quality assurance, conduct of operations, etc.) will be performed by specially constituted teams formed by the PMT. The aim of this activity is to identify a tailored set of standards and requirements that will assure adequate safety when implemented.

The process management team shall provide additional technical resources as required to identify the standards.

Standards experts shall be drawn from the following RPP-WTP organizations:

- Staff of the Engineering Manager
- Technical staff of the ES&H Manager

The standards identified are evaluated and tailored for each control strategy based on compliance with applicable laws and regulations and conformance with the DOE-stipulated top level standards, plus the output of the preceding hazard evaluation and control strategy development steps. Typical considerations include the following:

- The severity level of the hazard
- The number of independent SSCs that comprise the control strategy
- The control strategy functions - recognizing that a specific control strategy may have multiple functions and serve to control multiple hazards
- The service environment
- The applicable design basis events
- The target reliability for the control strategy

The target frequencies described in section 4 provide a basis for establishing target reliabilities for the SSCs that comprise the control strategy. The combined reliability of the preventive SSCs and the SSCs that provide mitigation must be consistent with the target frequency for the unmitigated event. The reliability of the preventive SSCs should be consistent with the release frequency used to determine the degree of mitigation provided.

Documentation of the standards and requirements identification process provides justification of the set selected and links each control strategy to its associated set of standards. The information generated during standards selection is retained in database form for each control strategy:

- Control strategy
- Service environment
- Applicable design basis events
- Applicable standards
- Performance requirements

- Testing/calibration requirements
- In-service inspection requirements
- Maintenance requirements
- Quality level
- Standards justification

This information is structured so it can be linked to the control strategies in the hazard schedule. This provides a link from the hazards through the control strategies to the standards. Not all of this information will be available early in the design. For example, it will not be possible to define maintenance and testing requirements until the design is mature.

The standards identified through this activity shall be reflected in the SRD.

As the standards are tailored, discrepancies with the current version of the SRD may arise. Such discrepancies shall be recorded. Formal changes to the SRD require approval from DOE.

8.0 Confirmation of Standards

Based on the recommendation of the PMT, the RPP-WTP Project Safety Committee (PSC) Chair requests the PSC to confirm the selected set of standards. The PSC defines a review approach, carries out the review, and documents the findings of the review. Resolution of PSC comments shall be documented.

9.0 Formal Documentation

Following confirmation by the PSC, the results of the standards selection process shall be documented in the Safety Requirements Document (SRD). The SRD shall incorporate documentation supporting these results by reference. The SRD shall identify and justify the set of requirements and standards selected to provide adequate protection of workers, the public, and the environment.

10.0 Recommendation

The recommended set of standards shall be certified in accordance with project implementing documents. When properly implemented, the set of standards:

1) Provides adequate safety
2) Complies with applicable laws and regulations
3) Conforms with the Top-Level Safety Standards and Principles

11.0 Definitions

Credible event: Any event with a frequency greater than 10^{-6} per year, including allowance for uncertainties.

Important to Safety: Structures, systems, and components that serve to provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the workers and the public. It encompasses the broad class of facility features addressed (not necessarily explicitly) in the top-level radiological, nuclear, and process safety standards and principles that contribute to the safe operation and protection of workers and the public during all phases and aspects of facility operations (i.e., normal operation as well as accident mitigation).

This definition includes not only those structures, systems, and components that perform safety functions and traditionally have been classified as safety class, safety-related, or safety-grade, but also those that place frequent demands on or adversely affect the performance of safety functions if they fail or malfunction, i.e., support systems, subsystems, or components. Thus, these latter structures, systems, and components would be subject to applicable top-level radiological, nuclear, and process safety standards and principles to a degree commensurate with their contribution to risk. In applying this definition, it is recognized that during the early stages of the design effort all significant systems interactions may not be identified and only the traditional interpretation of important to safety, i.e., safety-related, may be practical. However, as the design matures and results from risk assessments identify vulnerabilities resulting from non-safety-related equipment, additional structures, systems, and components should be considered for inclusion within this definition.

Mitigated event: As used in this standard, a mitigated event involves the following sequence:

- An initiating event that could lead to a release from the primary confinement barrier
- Failure of all elements of the control strategy that would prevent the initiating event from developing into a release from the primary confinement barrier
- Mitigation of the consequences of the release as provided by the control strategy

Mitigated event frequency: The mitigated event frequency is the corresponding release frequency times the probability that the elements of the control strategy that mitigate the release will function given the release.

Release frequency: The release frequency is the product of the frequency of the initiating event times the probability that all elements of the control strategy that would prevent the release fail, given the initiating event.

Reliability: The probability that an SSC will perform its safety function when required.

Unmitigated event: As used in this standard, an unmitigated event involves the following sequence:

- An initiating event that could lead to a release from the primary confinement barrier
- Failure of all elements of the control strategy that would prevent the initiating event from developing into a release from the primary confinement barrier
- Failure of all elements of the control strategy that would mitigate the consequences of the release

Unmitigated event frequency: The frequency of an unmitigated event is the corresponding release frequency times the probability that all elements of the control strategy that would mitigate the release fail, given the release.

Appendix D

Radiological Exposure Standards for the WTP Project

CONTENTS

1.0 Introduction and Purpose

This attachment to the SRD originally was issued as a stand-alone document (BNFL-5193-RES-01, Revision 0, dated 28 August 1997). It has been incorporated into the SRD because it provides both background information and the basis for the radiological exposure standards reflected in the SRD Safety Criteria. In addition, it has been updated to reflect responses to DOE questions on the Standards Approval Package. It has also been updated to reflect a change in the radiological exposure standards for facility workers and collocated workers in the extremely unlikely event frequency range.

This document is the Radiation Exposure Standard for Workers under Accident Conditions, which is a radiological safety deliverable. This document is used during the process hazards analysis (PHA) and accident analysis to ensure worker safety through identification of the need for accident prevention and mitigation features that provide worker protection against radiological and nuclear hazards. In this document, where unmodified reference is made to workers, it applies collectively to facility workers and collocated workers as defined in sections 3.5.1 and 3.5.2 below.

The US Department of Energy (DOE), in DOE/RL-96-0006, Revision 0, *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors*, (DOE-RL 1996), provides Table 1, “Dose Standards Above Normal Background”. In Table 1 (referred to as DOE Table 1), there are entries labeled, “To be derived”, for which the contractor is to propose specific exposure standards for both facility workers and collocated workers for the following events:

- **Unlikely Events**: events that are not expected but may occur during the lifetime of the facility in the range of frequency between 10^{-2}/yr and 10^{-4}/yr (between once in 100 years and once in 10,000 years)
- **Extremely Unlikely Events**: events that are not expected to occur during the lifetime of the facility but are postulated because their consequences would include the potential for the release of significant amounts of radioactive material. Extremely unlikely events are in the range of frequency between 10^{-4}/yr and 10^{-6}/yr (between once in 10,000 years and once in 1 million years).

This document provides the required exposure standards and the bases for their selection. In addition, this document presents the approach for complying with DOE Table 1. The individual elements of this approach, as shown in Table 2-1 of SRD Safety Criterion 2.0-1 (referred to as Table 2-1), are conservative based on the requirements of the contract and, as such, satisfy the contract. For completeness, this document also discusses, and presents in Table 2-1, public exposure standards and the assumed locations of the public, facility worker, and collocated worker for use in evaluation of accident consequences and normal radioactive material releases.

2.0 Exposure Standards for Facility and Collocated Workers

The four “To be derived” cells in DOE Table 1 have been completed by imposing a radiological exposure standard not to exceed 25 rem/event to the WTP facility workers or to collocated workers for ~~either~~ unlikely events ~~or~~ and 100 rem/event to the WTP facility workers or to collocated workers for extremely unlikely events.

The 25 rem/event exposure standard for both the facility and collocated workers for ~~unlikely and extremely~~ unlikely events corresponds to the once-in-a-lifetime accident or emergency exposure for radiation workers which, by recommendation of the National Committee on Radiation Protection (NCRP 1963), may be disregarded in the determination of their radiation exposure status. In addition, an exposure of 25 rem/event corresponds to a conditional probability of fatality of about 2 x 10^{-2}. For unlikely events (defined in Table 2-1 as having a maximum occurrence frequency of 10^{-2}/yr), this equates to a maximum increase in worker lifetime risk of premature death of only 2 x 10^{-4}, which is considerably less than the average accidental death risk for workers in some of the safest industries (i.e., retail and wholesale trade, manufacturing, and service [EPA 1991]).

The 100 rem/event exposure standard for both the facility and collocated workers for extremely unlikely events is consistent with the worker exposure standard being employed elsewhere in the DOE complex including the Hanford Site. In addition, an acute radiation dose of approximately 100 rem carries almost no risk of prompt death [DOE 1994a].

Compliance with ~~the 25 rem/event standard~~these worker exposure standards is established using qualitative methods supported, where necessary, by numerical analysis that may include the development of event trees and fault trees and/or the performance of consequence analyses. From this process, preventative and mitigative engineered and administrative controls are identified.

Use of qualitative methods is consistent with the American Institute of Chemical Engineers (AIChE) guidelines (AIChE 1992), US Nuclear Regulatory Commission (NRC) guidance for the performance of integrated safety analysis for 10 *Code of Federal Regulations* (CFR) 70 special nuclear material licensees (NRC 1995a), as well as DOE-STD-3009 (DOE 1994) and DOE G 420.1-X (DOE 1995). Both DOE documents state the following:

> "Estimates of worker consequences for the purpose of a safety-significant SSC designation are not intended to require detailed analytical modeling. Considerations should be based on engineering judgement of possible effects and the potential added value of safety-significant SSC designation."

Because the primary purpose of the WTP Project facility and collocated worker exposure standards is to identify structures, systems, and components (SSC) required to protect these workers, the guidance cited above is both applicable and appropriate.

The principal approach for complying with the ~~25 rem/event~~ worker exposure standards is the PHA. The PHA is a systematic, team-based review of the plant and treatment processes. The PHA identifies hazards and operability problems to a level of detail commensurate with the design detail available. Further hazard evaluation takes place in parallel with design development to ensure that safety continues to be built into the design process.

Having generated the list of hazards and hazardous situations, this list is subject to a further systematic team-based review where a binning process takes place. The binning process assigns postulated events to a certain hazard category and is essentially risk-based with categories of hazard defined according to a frequency/consequence matrix.

The ~~25 rem/event standard~~worker exposure standards for unlikely or extremely unlikely events ~~applies~~ apply to events with frequencies less than 10^{-2}/yr. For those frequencies, the PHA process assigns serious and major hazardous situations as undesirable, acceptable with controls, or acceptable. For a hazardous situation to be "acceptable", its consequences must be less than ~~25 rem~~the corresponding worker exposure standard. Where there is uncertainty as to where an event should be binned (i.e., assigning a hazard category), it is binned into a higher category to ensure that the accident analysis remains conservative.

The DOE-RU has provided a guidance document (DOE-RL 1997) to be used for review of the Radiation Exposure Standard for Workers Under Accident Conditions. This guidance document includes the worker accident risk goal and the accident risk goal of DOE/RL-96-0006.

The worker accident risk goal is stated in DOE/RL-96-0006 as, "The risk, to workers in the vicinity of the Contractor's facility, of fatality from radiological exposure that might result from an accident should not be a significant contributor to the overall occupational risk of fatality to workers".

DOE/RL-97-09 (DOE-RL 1997) describes approaches that can be taken to meet this goal. The simplest approach notes that the goal can be met when (a) a worker dose standard that does not exceed 100 rem is used for extremely unlikely events (10^{-4} to 10^{-6} probability range), and (b) a worker dose standard that does not exceed 10 rem is used for unlikely events (10^{-2} to 10^{-4} probability range). For the latter probability range, the 10-rem standard relies on the assumption that the probability of accidents is evenly distributed across the probability range.

Based on experience with similar plants, it is considered unlikely that the even distribution assumption will represent the actual situation for WTP. Furthermore, experience indicates that there will be relatively few accidents falling into this range, and that they will be distributed toward the low probability end of the range. Consequently, a value higher than 10 rem can be used for the worker accident standard for unlikely events.

As can be seen in Table 2-1, a value of 25 rem/event is selected as the worker accident standard for ~~both unlikely and extremely~~ unlikely events. Because this is over 10 rem for the 10^{-2} to 10^{-4} probability range, satisfaction of the worker accident risk goal needs to be demonstrated.

For the WTP, this goal is satisfied by calculating the risk of facility operation to the workers. This is a best estimate analysis based on realistic input and modeling assumptions. In performing this analysis, all structures, systems, and components capable of preventing or mitigating the event are considered. Estimates of system and component unavailabilities and unreliabilities consider failure to start and failure to run as well as maintenance-caused unavailabilities. Accident prevention and mitigation features are added to the design as necessary to satisfy the worker accident risk goal. Note 2 of Table 2-1 explicitly commits the WTP contractor to this risk evaluation process.

The accident risk goal is stated in DOE/RL-96-0006 as, "The risk, to an average individual in the vicinity of the Contractor's facility, of prompt fatalities that might result from an accident should not exceed one-tenth of one percent (0.1%) of the sum of prompt fatality risks resulting from other accidents to which members of the U.S. population are generally exposed." The DOE guidance document states that a radiation exposure standard of 100 rem/event would satisfy the accident risk goal. Because the WTP standard is ~~25~~ 100 rem/event, the guidance document is satisfied.

In each of the four cells addressing accident exposure standards for workers and collocated workers in the unlikely and extremely unlikely events ranges, an ALARA accident limit is not specified. However, Note 3 of Table 2-1 states:

> "In addition to meeting the listed dose standards for accidents, the approach to accident mitigation is to evaluate accident consequences to ensure that the calculated exposures are far enough below standards to account for uncertainties in the analysis, and to provide for sufficient design margin and operational flexibility."

This approach provides an adequate level of safety. The following paragraphs should also be noted in support of this conclusion.

The accident analyses will show compliance with exposure standards for accidents. In addition, a defense-in-depth approach provides multiple levels of protection that ensure worker exposures from accidents will be significantly lower than calculated. This is a proven approach, considered to be effective at minimizing exposures to workers.

The approach to accident mitigation (as described in Note 3 of Table 2-1) is to examine accident consequences to ensure that calculated exposures are far enough below standards to account for uncertainties in the analysis and to provide sufficient design margin and operational flexibility. This approach is employed for all accidents (including both public and workers at all accident frequency levels) that can challenge the exposure standards, ensuring that accident exposures would be well below standards.

3.0 Development of the BNI Approach to Compliance with Table 1 of DOE/RL-96-0006

The overall approach to complying with DOE Table 1 is presented in this document. This approach takes the form of Table 2-1. The "To be derived" cells have been completed as discussed. The remaining cells of Table 2-1 are either identical or conservative with respect to DOE Table 1. The following sections discuss differences between DOE Table 1 and Table 2-1.

DOE Table 1 footnotes are not shown in Table 2-1. Section 2.1 of DOE/RL-96-0006 states that the footnotes refer only to the origin of the specific standards and, as such, are not considered contractual requirements unless included elsewhere in the contract.

3.1 Estimated Frequency of Occurrence

The second column of DOE Table 1, "Estimated Probability of Occurrence (P) (yr^{-1})," has been titled in Table 2-1, "Estimated Frequency of Occurrence (f) (yr^{-1})". In addition, the estimated frequency of occurrence for normal events of DOE Table 1 is redefined in Table 2-1 as any normal event regardless of frequency (nominally taken to be a frequency > 0.1/yr). The estimated frequency of anticipated events in DOE Table 1 is redefined as events with an annual frequency of occurrence of $10^{-2} < f\ 10^{-1}$.

With these changes, events routinely performed (e.g., melter replacement) are considered normal events rather than accidents, irrespective of frequency of occurrence. As normal events, the radiological assessment is subject to the more restrictive "per year" exposure standards rather than "per event" exposure standards. Consequently, these changes are conservative in comparison to DOE Table 1.

3.2 Normal Events/Public and Workers Exposure Standards

Clarifying descriptions have been included in the Normal Events/Public cell of Table 2-1 explaining that the second 100 mrem/yr standard applies to a member of the public entering the controlled area and the 25 mrem/yr standard is the public primary exposure standard for radioactive waste. The removal of DOE Table 1 footnotes (as noted above) necessitated the addition of these clarifying notes.

For the Normal Events/Worker and Normal Events/Collocated Worker cells of Table 2-1, the DOE Table 1 standard of 1.0 rem/yr ALARA design limit is replaced by a standard of 1.0 rem/yr ALARA design objective per 10 CFR 835, section 1002(b). The corresponding worker standards for normal events in DOE Table 1 are tied to the ALARA design objectives of 10 CFR 835.1002(b) by the footnotes to DOE Table 1.

BNI has committed to full compliance with 10 CFR 835 in the SRD, and the other sections of 10 CFR 835.1002 provide adequate requirements to ensure routine worker exposures will be ALARA. In addition, a footnote, Note 1, is included in Table 2-1. This note states the following:

> "In addition to meeting the listed design objective of 10 CFR 835.1002(b), the inhalation of radioactive material by workers and collocated workers under normal conditions is kept ALARA through the control of airborne radioactivity as described in 10 CFR 835.1002(c)."

3.3 Anticipated Events/Worker and Collocated Worker Exposure Standards

References to as low as reasonably achievable (ALARA) standards have been removed for the Anticipated Events/Worker and Collocated Worker cells of Table 2-1. The ALARA design objective of 10 CFR 835, "Occupational Radiation Protection", is applied to normal events as shown in Table 2-1. However, with the redefinition in Table 2-1 of anticipated events as those events with an annual frequency of occurrence of $10^{-2} < f \leq 10^{-1}$, the ALARA objective no longer applies because anticipated events are not part of normal operation.

This change complies fully with section 3.2, "Radiation Protection Objective", of DOE/RL-96-0006, which states the following:

> "Ensure that during normal operation radiation exposure within the facility and radiation exposure and environmental impact due to any release of radioactive material from the facility is kept as low as is reasonably achievable (ALARA) and within prescribed limits, and ensure mitigation of the extent of radiation exposure and environmental impact due to accidents."

This aspect of Table 2-1 also represents compliance with contractual requirements because footnote 3 of DOE Table 1 references 10 CFR 835.1002(b). This section, and 10 CFR 835.202 which it references, establishes design requirements for occupational exposures other than planned special exposures and emergency exposures. Administrative limits for planned special exposures and emergency exposures are addressed in 10 CFR 835.204 and 10 CFR 835.1302 and are complied with by the WTP.

Finally, to provide an adequate level of safety and to ensure that cost-effective safeguards affecting anticipated events are evaluated (and incorporated as appropriate) whenever the final calculated event consequence to a worker or collocated worker is 1 rem or more, the approach specifies a 1.0-rem/event design action threshold standard. In addition, a note is included in Table 2-1 to explain the application of the standard. This note (Note 4 to Table 2-1) states:

> "When a calculated accident exposure exceeds this threshold, then appropriate actions are taken. These include carrying out a less bounding (i.e., more realistic) evaluation to show that the accident consequences will be below the threshold or evaluating additional safeguards for cost-effectiveness and/or feasibility. This threshold is not a limit; it does not require the implementation of additional preventative or mitigative features if they are not both cost-effective and feasible."

3.4 Extremely Unlikely Events/Public Exposure Standard

A standard is included in the Extremely Unlikely Events/Public cell of Table 2-1 stating that a public exposure standard target value of 5 rem/event is applied to extremely unlikely events. This target value is based on the following:

- The philosophy is that the public should be protected by a lower exposure standard than a worker. This philosophy recognizes the fact that the worker has agreed to work on the Hanford Site and has received training for avoiding hazards and dealing with hazardous situations.
- A goal to facilitate transition to the NRC as the regulatory agency with jurisdiction over nuclear safety for DOE facilities. With the exception of a 25 rem/event guideline value of 10 CFR 100 for the establishment of the exclusion area and low population zone for commercial power reactors, the NRC has not established a public exposure standard that exceeds 5 rem/event. A public exposure standard of 5 rem/event is also included in proposed rulemaking for 10 CFR 70 (NRC 1995b), which further supports the Table 2-1 value.
- With the same 5 rem/event public exposure standard for both unlikely and extremely unlikely events, there is no need to bin accidents in one of these two event frequency categories for the purpose of establishing protection of public safety.

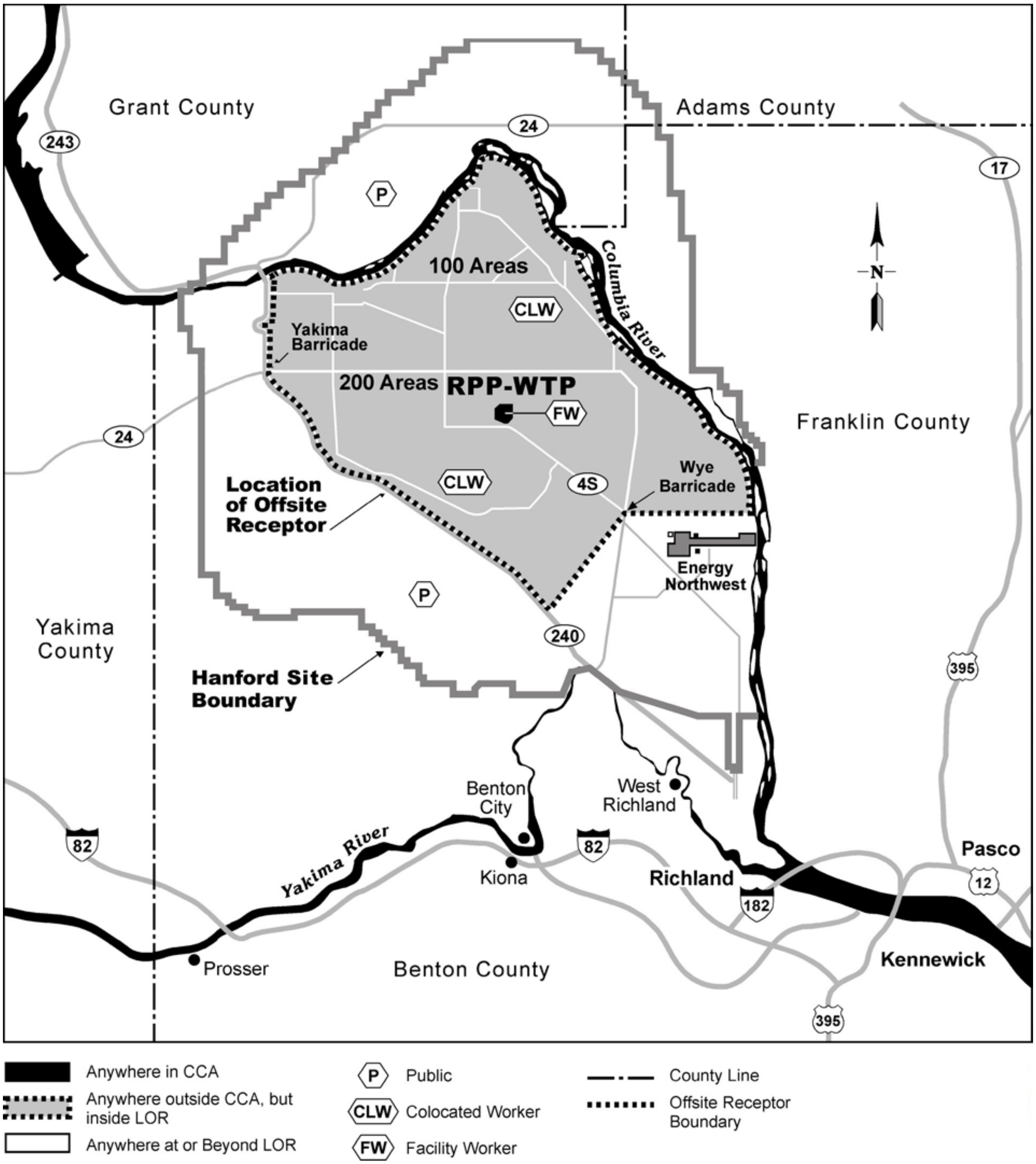
3.5 Location of Receptors

In Table 2-1, a new last row has been added to clarify in DOE Table 1 of DOE/RL-96-0006 the assumed location for the facility worker, the collocated worker, and the public, for the purpose of establishing compliance with the radiological standards of DOE Table 1. The bases for the receptor locations included in this row are provided below.

3.5.1 Facility Worker

The facility worker is located at the most limiting location within the WTP contractor-controlled area as defined in DOE/RL-96-0006, as shown in Figure D-1.

Figure D-1 Location of Facility and Collocated Workers



Section 6.0, "Glossary", of DOE/RL-96-0006 defines the controlled area as the following:

> "The physical area enclosing the facility by a common perimeter (security fence). Access to this area can be controlled by the Contractor. The controlled area may include identified restricted areas."

The controlled area for WTP used to define the location of the facility worker, is that land within the WTP security fence.

3.5.2 Collocated Worker

Section 6.0, "Glossary", of DOE/RL-96-0006 defines the collocated worker as the following:

> "An individual within the Hanford Site, beyond the Contractor-controlled area, performing work for or in conjunction with DOE or utilizing other Hanford Site facilities."

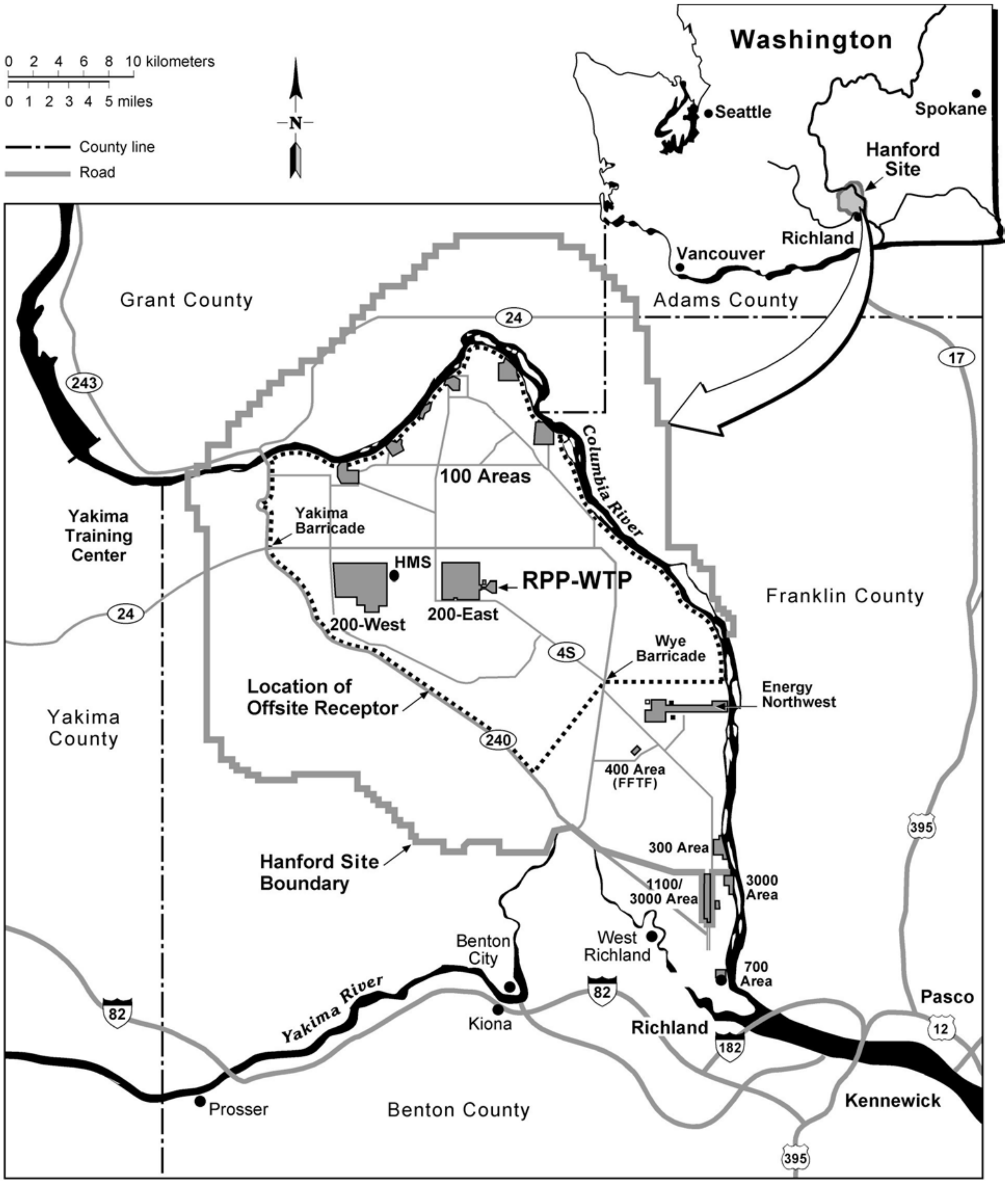
For evaluation of the WTP design to the exposure standards of DOE Table 1, the location of the collocated worker is either at the controlled area boundary or beyond that boundary if such a location results in higher exposure. For a ground-level release, the location of the collocated worker is considered no closer than 100 m from the release point.

3.5.3 Public

The location of the public (i.e., the offsite receptor) for the purpose of establishing compliance with the last column of DOE Table 1 of DOE/RL-96-0006, is established at the most limiting exposure location along the near bank of the Columbia River, Highway 240, and a southern boundary as shown in Figure D-2.

This area includes land for which it is reasonable to assume DOE will retain the right to control activities and limit access under accident conditions for the operating life of the WTP. Specifying the near river bank excludes the Columbia River for which DOE does not control activities (DOE-RL 1995). Specifying Highway 240 excludes the Arid Lands Ecology Reserve of which DOE might relinquish control during the operating life of the WTP. The southern boundary serves to exclude Energy Northwest's Columbia Generating Station, a commercial nuclear power plant (whose workers should be considered members of the public), and the Hanford Site 300, 400, and 1100 Areas. The 400 Area includes the Fast-Flux Test Facility.

Figure D-2 Boundary for Location of Offsite Receptor for the Purpose of Implementing DOE/RL-96-0006, Rev. 0, Table 1, Public Exposure Standard



In footnotes 10 and 12, DOE Table 1 of DOE/RL-96-0006 makes reference to 10 CFR 72, "Licensing Requirements for the Independent Spent Fuel (ISFSI) and High Level Radioactive Waste," and 10 CFR 100, "Reactor Site Criteria," to relate to the public exposure standards for unlikely and extremely unlikely events. While the siting requirements and guidance of Parts 72 and 100 are not applicable to the WTP, the requirements for establishing the location of the offsite receptor in these two cited regulations are useful for locating the offsite receptor for a waste processing facility such as WTP. Section 72.106, "Controlled Area Boundary of an ISFSI or Monitored Retrievable Storage (MRS)", includes the following statements relative to the boundary to be assumed for the evaluation of radiological exposure to the public:

> "The minimum distance from the spent fuel or high-level radioactive waste handling and storage facilities to the nearest boundary of the controlled area shall be at least 100 meters."
>
> "The controlled area may be traversed by a highway, railroad or waterway, so long as appropriate and effective arrangements are made to control traffic and to protect public health and safety."

Title 10 CFR 100 establishes a guideline value of 25 rem for 2 hr at the exclusion area boundary. For the exclusion area, 10 CFR 100.3, "Definitions", states the following:

> "(a) *Exclusion area* means that area surrounding the reactor, in which the reactor licensee has the authority to determine all activities including exclusion or removal of personnel and property from the area. This area may be traversed by a highway, railroad, or waterway, provided these are not so close to the facility as to interfere with normal operations of the facility and provided appropriate and effective arrangements are made to control traffic on the highway, railroad, or waterway, in case of emergency, to protect the public health and safety. Residence within the exclusion area shall normally be prohibited. In any event, residents shall be subject to ready removal in case of necessity. Activities unrelated to operation of the reactor may be permitted in an exclusion area under appropriate limitations, provided that no significant hazards to the public health and safety will result."

As can be seen from the above excerpts, the assumed location for the offsite receptor for WTP is consistent with 10 CFR 72 and 10 CFR 100. In addition, the proposed southern boundary takes advantage of the road junction at the Wye barricade (Figure F-1) for control of access to the site during accident conditions.

4.0 References

10 CFR 70, "Domestic Licensing of Special Nuclear Material", *Code of Federal Regulations*, as amended.

10 CFR 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste", *Code of Federal Regulations*, as amended.

10 CFR 100, "Reactor Site Criteria", *Code of Federal Regulations*, as amended.

10 CFR 835, "Subpart C - Standards for Internal and External Exposure", *Code of Federal Regulations*, as amended.

AIChE, 1992, *Guidelines for Hazards Evaluation Procedures, Second Edition with Worked Examples*, Center for Chemical Process Safety, American Institute of Chemical Engineers, New York, New York.

DOE 1994, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, DOE-STD-3009-94, US Department of Energy, Washington, DC.

DOE 1994a, *Methods for the Assessment of Worker Safety under Radiological Accident Conditions at Department of Energy Nuclear Facilities*, EH-12-94-01, US Department of Energy, Office of Environment, Safety and Health, Office of Nuclear Safety, Washington, DC.

DOE 1995, *Implementation Guide for Nonreactor Nuclear Safety Design Criteria and Explosives Safety Criteria*, DOE G 420.1-X, Revision G, US Department of Energy, Washington, DC.

DOE-RL 1995, *Clarification of Hanford Site Boundaries for Current and Future Use in Safety Analysis*, letter Walter B. Scott, DOE-RL to Contractors, dated 26 September 1995, US Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL 1996, *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors*, DOE/RL-96-0006, Revision 0, US Department of Energy, Richland Operations Office, Richland Washington.

DOE-RL 1997, *Guidance for Review of TWRS Privatization Contractor Radiation Exposure Standards for Workers*, DOE/RL-97-09, US Department of Energy, Richland Operations Office, Richland Washington.

EPA 1991, *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*, US Environmental Protection Agency, Washington, DC.

NCRP 1963, *Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure*, Handbook 69, Addendum 1, National Bureau of Standards, Washington, DC.

NRC 1995a, *Integrated Safety Analysis Guidance Document*, NUREG-1513, Draft, US Nuclear Regulatory Commission, Washington, DC.

NRC 1995b, *Preliminary Working Draft of Revision of 10 CFR 70 Updated*, 5 April 1995, provided at the NRC public meeting of May 2, 1995, US Nuclear Regulatory Commission, Washington, DC.

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Attachment 2

Proposed Changes to the *Integrated Safety Management Plan*

Document Part	**Title**	**Starting Page**	**No. of Pages**
Section 1.0	Project Safety Approach	1-1	25
Section 13.0	References	13-1	4

# of pages (including cover sheet): 30

1.0 Project Safety Approach

The WTP Contractor's safety approach is implemented with the recognition that the defined work for processing and immobilizing Hanford tank waste involves inherent radiological and chemical hazards from which hazardous situations may arise. The WTP Contractor is committed to integrating the development of safety criteria and design requirements, the hazard analysis and accident analysis process, and the facility design to minimize the risk associated with these hazards and hazardous situations. The WTP Contractor accepts responsibility for the safety of the WTP and for adequate protection of the health and safety of the public, worker safety, environmental protection, and compliance with applicable laws and regulations.

This chapter of the Integrated Safety Management Plan (ISMP) provides an overview of the WTP design, construction, and commissioning (DC&C) Contractor (i.e., Bechtel National, Inc. [BNI]) safety approach developed for the River Protection Project – Waste Treatment Plant (WTP). The elements of this approach, through their evolutionary implementation in Part A of the project, form the bases for this ISMP. The ISMP is followed and will be further developed during Part B of the Project for detailed design, construction, operation, and deactivation of the facility.

The Project safety approach is summarized in Section 1.1, "Introduction". The components of the safety approach are described in greater detail in Section 1.2, "Summary". The elements of the safety approach are described in Section 1.3, "Description of the Integrated Safety Management Plan".

1.1 Introduction

The safety management practices outlined in the ISMP have been developed specifically for the Project. The development of these management practices was based on the experience of the Project team at other nuclear facilities in the areas of design, construction, and operation. These practices ensure implementation of the corporate policy that no activities are more important than the health and safety of its workers, contractors, the public, or protection of the environment.

The ISMP documents the process by which laws, regulations, and standards applicable to the nuclear, radiological, and process safety aspects of the Project are incorporated into programs for facility design, construction, operation, and deactivation to ensure adequate safety of workers and the public and protection of the environment. A further role of the ISMP is to demonstrate how practices are in line with the WTP Contractor policies to ensure that the safety culture achieved at other nuclear chemical facilities can be successfully sustained through the different phases of the WTP. At this stage in the project, the ISMP is biased towards the design and construction phase, during which most of the processes described are developed. However, the principles of the ISMP for later stages of the facility life through operation and deactivation and how the design and construction phase will be integrated into these later stages is discussed. The ISMP also describes how the safety management practices will be followed and further developed during Part B of the Project.

Table 1-1 BNFL Team Experience Related to the TWRS-P Project (this table has been deleted)

To accomplish its roles, the ISMP describes the following:

1) The facility defined work to process and immobilize Hanford Tank waste in a safe manner (ISMP Section 1.3.1, "Project Initiation")

2) The selection of a safe and proven technology (ISMP Section 3.7, "Proven Engineering Practices")
3) The development and use of the SRD (ISMP Section 1.3.3, "Safety Requirements Document")
   a) To establish the Safety Criteria by which the process hazard analysis (PHA) and accident analysis identify features required for worker and public safety
   b) To identify the design requirements that, when implemented, ensure that prevention and mitigation controls will perform their specified safety functions
4) The use of PHA to identify the full range of potential radiological and chemical hazards and hazardous situations (ISMP Section 1.3.4, "Process Hazards Analysis")
5) The accident analyses performed to identify engineered and administrative controls required for worker and public safety (ISMP Section 1.3.6, "Accident Analysis")
6) The iteration of the PHA, accident analyses, and design to ensure an adequate level of safety for the workers and the public (ISMP Sections 1.3.7, "Acceptable Level of Public Safety" and 1.3.8, "Acceptable Level of Worker Safety")
7) The development of the technical safety requirements, if required, that are based on:
   a) A process variable, design feature, or operating restriction that is an initial condition (i.e., the assumed facility state) for an accident analysis
   b) Structures, systems, and components that must function to maintain compliance with public and worker radiological and chemical exposure standards
8) The development of procedures and training to achieve and maintain the required administrative controls (ISMP Sections 1.3.12, "Training" and 1.3.13, "Procedures")
9) The development of an emergency preparedness program and implementing procedures (ISMP, Section 1.3.18, "Emergency Planning")
10) The assignment of design, construction, and operational roles and responsibilities and the use of assessments to ensure the necessary attributes of the ISMP are effectively accomplished (ISMP, Chapters 10.0, "Assessments", and 11.0, "Organizational Roles, Responsibilities, and Authorities")

Chapter 1.0 of the ISMP presents the BNI safety approach. Chapters 2.0 through 11.0 are formatted to correspond to the attributes included in RL/REG-97-07, *Guidance for the Review of TWRS Privatization Contractor Integrated Safety Management Plan Submittal Package* (DOE-RL 1997).

Throughout the ISMP, lists of items are numbered for the convenience of the reviewers in referring to individual items. The numbering is not an indication of the importance or sequence of the items.

Chapter 12.0, "Definitions", contains the definitions of some of the terms, phrases, or documents that are found throughout the ISMP. When used unmodified in the ISMP, "worker" refers to the facility and collocated worker, both individually and collectively.

Within this document, the *Safety Requirements Document* (SRD) (BNI 2001b and BNI 2001c), *Hazard Analysis Report* (HAR) (BNFL 1997b), *Quality Assurance Program* (QAP) (BNFL 1997a, BNFL 1998c), *Quality Assurance Manual* (QAM) (BNI 2001), and *Initial Safety Analysis Report* (ISAR) (BNI 2001d and 2001e), are cited using acronyms. Full reference information for these documents appears in Chapter 13.0, "References".

1.2 Summary

The Project safety approach is implemented with the recognition that the defined work of processing and immobilizing Hanford tank waste involves inherent radiological and chemical hazards from which hazardous situations may arise. The Project is integrating the development of Safety Criteria, design requirements, the hazard analysis and accident analysis processes, and the facility design to minimize the risk associated with these hazards and hazardous situations. The elements of this approach, through their evolutionary implementation in Part A of the Project, form the bases for this ISMP.

The safety approach for the Project is based on applying best industry practices and cost-effective processes that come from successful and safe operation in the commercial nuclear environment and the chemical process industry. The purpose of the safety approach is to achieve the following objectives.

1) Ensure an adequate level of safety at the facility for the workers and the public.
2) Comply with applicable laws and regulations.
3) Conform to top-level safety standards and principles stipulated by the U.S. Department of Energy (DOE-RL 1996b).

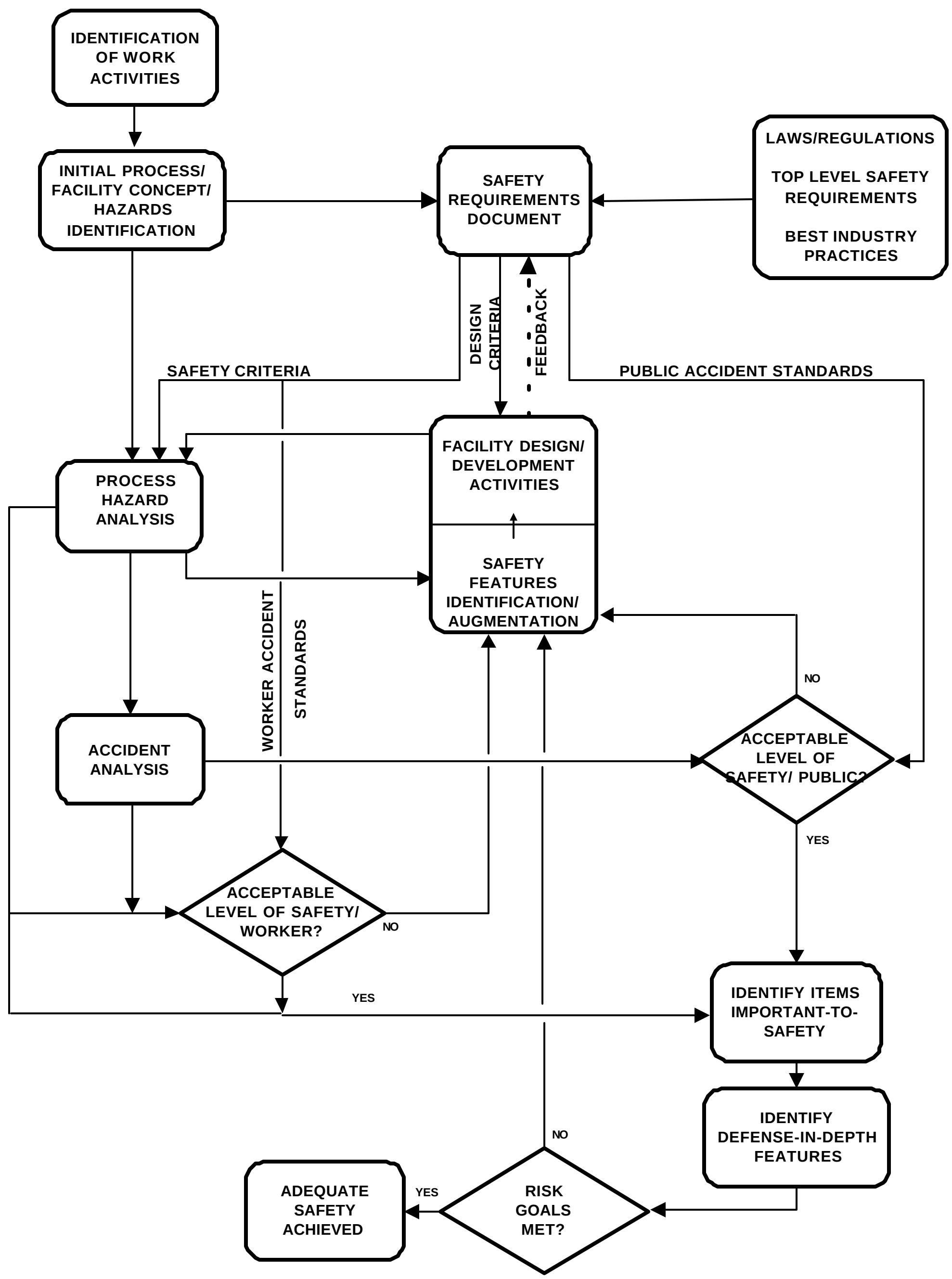
A diagram of the Project safety approach is presented in Figure 1-1. The safety approach begins with the definition of the work to be performed and continues with the development of the conceptual process flow diagrams (PFD) and other facility design information required to accomplish the defined work. The PFDs and design development give consideration to the types of work to be accomplished, the hazards identified for similar facilities, and the methods by which these hazards were previously eliminated or controlled for similar facilities. This conceptual information is used to identify appropriate hazards-based standards and initiate the development of the SRD.

The identification of hazards and hazardous situations helps to characterize the hazardous situations as those that may require prevention or mitigation. The identification and characterization of the hazards and hazardous situations establish a basis for describing approaches and measures to control the hazards. Safety Criteria are then developed that document the set of standards and requirements necessary to ensure implementation of the necessary hazard control strategies. These Safety Criteria are documented in the SRD and are based on applicable laws and regulations, the U.S. Department of Energy's (DOE) top-level safety requirements, and best industry practices. The SRD provides Safety Criteria to the PHA by which an initial assessment of the adequacy of the design is made.

As accident prevention and mitigation safety features are identified in the PHA, the resulting facility design impacts are fed back to the SRD process, as required, for further development of more detailed Safety Criteria and design requirements to ensure all safety features provide their specified safety functions.

As the PHA, PFDs, and facility design mature, accident analyses are performed to confirm judgements made during the PHA and to further characterize the accident scenarios to demonstrate compliance with radiological and chemical exposure standards for accidents. Additional protection for workers is identified by the PHA, the accident analyses, and the application, as appropriate, of Process Safety Management (PSM) required by 29 CFR 1910.110.

Figure 1-1 Project Safety Approach



Significant features of the Project safety approach are described as follows.

1) The approach continually integrates hazard identification, SRD development, design development, and accident analysis throughout the facility design, construction, operation, and deactivation phases.

2) The approach uses the best industry practices that include PHA, a rigorous design process based on a set of credible accidents and a defense-in-depth philosophy, and verification of the level of facility safety through accident analysis and validation of requirements implementation.
3) The PHA identifies and evaluates the significance of potentially hazardous situations. For each identified event, a defense-in-depth approach applies a level of protection in terms of engineered features and administrative controls that is commensurate with the severity of the unmitigated event. The hazards evaluation techniques satisfy the requirements of a hazards analysis process established by the American Institute of Chemical Engineers (AIChE 1992).
4) A conservative approach to accident consequence analysis is used in terms of input assumptions, boundary conditions, and modeling techniques. As the process and facility design mature, the modeling is refined to eliminate unnecessary conservatism. This strategy is consistent with risk-based approaches that allow the use of uncertainty analysis to better identify the impact of assumptions and state of knowledge on results from the safety analyses.
5) The safety approach documents how the identification of the engineered and administrative controls credited for public and worker safety and facility Safety Criteria is accomplished.

This approach to safety analysis is similar to that described in draft NUREG 1513, *Integrated Safety Analysis Guidance Document,* (NRC 1994) published by the U.S. Nuclear Regulatory Commission (NRC).

1.3 Description of the Integrated Safety Management Plan

Each of the elements of the safety approach are described in detail in the following sections.

1.3.1 Project Initiation

The Project safety approach began with a discussion to aid in understanding of the work to be accomplished and the development of the conceptual design of the processes and facility to accomplish this work. The development of the conceptual design considered the work to be performed, hazards and hazardous situations identified for similar facilities, and the methods to eliminate or control these hazards and hazardous situations. Early in the development of the conceptual design, hazards identification and evaluation techniques appropriate for the preliminary nature of the process and facility design were selected and applied.

1.3.2 Laws/Regulations/Top-Level Safety Requirements/Best Industry Practices

Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors, DOE/RL-96-0006 (DOE-RL 1996b) provides a set of top-level radiological, nuclear, and process safety standards and principles prescribed by DOE for accomplishing the required level of safety for the WTP. This document is used as one resource for the development of the SRD. Included in DOE/RL-96-0006 are radiological exposure and risk standards for evaluation of normal and offnormal events. Additional resources for the identification of standards were derived from the U.S. and United Kingdom (UK) commercial nuclear and chemical industries. The identification of the remaining requirements is described in the following section.

1.3.3 Safety Requirements

The SRD defines the Safety Criteria and the design requirements (implementing codes and standards) necessary to protect the public and workers from radiological, nuclear, and process hazards and hazardous situations. The Safety Criteria and codes and standards of the SRD are applied to the WTP. The SRD, as well as the ISMP, applies to Project contractors. By application of the SRD and ISMP to all Project activities, a consistent project-wide approach is applied to Environmental, Safety, and Health (ES&H) matters. The hazards and hazardous situations at the facility will change significantly throughout the construction, operation, and deactivation phases of the Project. The SRD was developed by an iterative process that will continue as the design matures through the construction, commissioning, operation, and deactivation of the facility. The development involved identifying the work to be performed, identifying hazards and hazardous situations of the facility operation by the PHA and accident analyses, reviewing of pertinent regulations and industry practices, and identifying engineered and administrative controls.

Once the work activity was identified for the Project and the hazards associated with this work determined, the Safety Criteria were defined by the requirements necessary to ensure protection of the public and workers from radiological, nuclear, and process hazards. The Safety Criteria are based on the following:

1) Mandated regulatory requirements (statutory and contractual; including those identified as top-level safety requirements [standards and principles]) and equivalent requirements
2) Requirements and guidance documents deemed relevant to waste management facilities such as this Project
3) Best industry practices from the government, commercial nuclear, and chemical industries

The engineered and administrative controls necessary to eliminate and control hazards and hazardous situations are established via the PHA, the accident analysis, and the necessary level of protection required to satisfy the SRD Safety Criteria. Once the controls are selected, the SRD identifies the implementing codes and standards necessary to ensure that engineered and administrative controls are properly designed, implemented, and maintained. The requirements, guidance documents, and practices are incorporated into the SRD, tailored toward applicability to WTP operations, the control of hazards, and the adequacy to protect public and worker health and safety. These codes and standards are used by the appropriate organizations to ensure that the design, construction, testing, and maintenance of Important-to-Safety SSCs are such that they can perform their specified public and worker safety functions when required. Additional detail on the SRD and definition of Important-to-Safety is provided in ISMP Section 4.1, “Safety Management Processes” and Section 1.3.10, “Classification of Structures, Systems, and Components”.

1.3.4 Process Hazards Analysis

The PHA process is a systematic team-based approach used to identify and analyze the significance of potentially hazardous situations associated with the operation and maintenance of the WTP. Other hazardous situations unique to the deactivation phase will be identified near the end of waste processing operations. The PHA process includes preliminary hazard analysis and Hazard and Operability (HAZOP) Analysis. The process is enhanced by the experience gained by the Project team from similar analyses performed at similar facilities. The PHA is performed to ensure the facility is designed to provide accident prevention and mitigation controls as required to meet safety criteria established for the protection of the public and workers. The PHA team includes members experienced in the engineering design and operation of the chemical process being evaluated and at least one member knowledgeable in the specific PHA methodology being used. The results of the PHA are also strengthened by the use of the operational and maintenance experience of the team members to compliment the design process. Specifically, the goals of PHA are to

1) Identify hazards and potential hazardous situations associated with a process or activity
2) Identify features in the design or operation of the facility that could lead to accidents
3) Assist designers in identifying the need for design features to eliminate or control hazards and hazardous situations
4) Identify principal operability concerns to assist designers in eliminating or minimizing the associated risk

The focus of the analysis is on process safety issues, such as the acute effects of unplanned radiological and chemical releases on the public or workers. The PHA supplements the more traditional industrial health and safety activities that consider, for example, protection against slips or falls, use of personal protective equipment, and monitoring for employee exposures. Additional detail on the PHA is provided in ISMP Section 5.5, "Process Hazards Analysis".

1.3.5 Facility Design/Development Activities and Safety Features Identification

The PHA and the accident analyses identify the need for accident prevention and mitigation controls to satisfy the SRD Safety Criteria. There will be differences between the prevention and mitigation techniques needed during facility operation and those needed during the deactivation process. Both sets of needs are communicated to the design groups for the selection of the most effective and efficient means of achieving the required controls. In the selection of required controls, preference is given to accident prevention over mitigation and engineered features over administrative controls. Preference is also given to passive engineered features over active engineered features (ISMP Section 3.7, "Proven Engineering Practices"). Reliance on human intervention would be used only when reliance on other means of eliminating or mitigating the hazardous situation cannot be used. The features identified are maintained or changed, as needed, as the facility moves from operation to deactivation. Control of the features is discussed in more detail in ISMP Section 3.5, "Quality Assurance Program (QAP)", Section 1.3.16, "Configuration Management", and Section 5.3, "Configuration Management".

1.3.6 Accident Analysis

During the design phase, the set of potential accidents identified by the PHA is carried forward to the accident analysis to identify the need for prevention and mitigation controls required during operation or for deactivation to satisfy the SRD Safety Criteria. The Project team experience with accident analyses for similar facilities is particularly valuable in developing the models for the accident scenarios to be analyzed. Well-established methods that include factors such as the material at risk and the rate and duration of the release of hazardous material are used in the determinations of the source terms (NRC 1988; DOE 1994).

Evaluating potential accidents involves the following tasks:

1) Separating the lower-risk accidents adequately addressed by the PHA from the higher-risk accidents that warrant quantitative analysis to confirm risk acceptance guidelines are satisfied
2) Grouping the accidents based on considerations such as the location of the accident, the phenomena involved, the accident type, and the nature of the hazardous material at risk

3) Calculating the radionuclide or chemical release from the facility and the impact of the release on the facility operators whose actions are credited to maintain the public and workers radiological and chemical exposures within defined standards

1.3.7 Acceptable Level of Public Safety

During the facility design evolution, a consequence analysis is performed for each accident involving a radionuclide or chemical release. For those accidents that involve a radionuclide release, the calculated exposures are compared to the radiological exposure standards of Table 1-2 to determine the need for accident prevention or mitigation features credited for public safety. For chemical release, the projected exposure is compared to the standards of SRD Safety Criterion 2.0-2. If the radiological or chemical release standards are not satisfied, the need for engineered or administrative controls to prevent or limit the release is addressed. These features are designed and maintained to the highest applicable standards to ensure their functional performance in the prevention or mitigation of accidents. Features credited for satisfying the public radiological exposure standards of Table 1-2 and chemical release exposure standards of SRD Safety Criterion 2.0-2 are classified as Safety Design Class (which is a subset of Important-to-Safety as discussed in Section 1.3.10, “Classification of Structures, Systems, and Components). The location of the public (i.e., offsite receptor) for the purpose of establishing compliance with Table 1-2 and the chemical release standard, is established at the most limiting exposure location along the near exposure bank of the Columbia River, Highway 240, and a southern boundary as shown in Figure 1-2. If credit is taken for operator action to satisfy the public radiological exposure standards of Table 1-2, adequate radiation protection is provided to permit access and occupancy of the control room or other control locations under accident conditions without personnel receiving radiation doses in excess of 5 rem total effective dose equivalent (TEDE), 30 rem thyroid, and 30 rem beta skin for the duration of the accident. In the event operator action is not required, other than immediate actions required to place the facility operation into a safe state, then the worker exposure standards of Table 1-2 apply. If credit is taken for operator action to satisfy public chemical exposure to the standards specified in SRD Safety Criterion 2.0-2, provisions are made so that the operator exposure does not exceed the standard specified in SRD Safety Criterion 4.3-7.

Table 1-2 Radiological Exposure Standards Above Normal Background

Description	Estimated Frequency of Occurrence f (yr^{-1})	General Guidelines	Worker	Collocated Worker	Public
Normal Events: Events that occur regularly in the course of facility operation (e.g., normal facility operations); including routine and preventative maintenance activities.	>0.1	Normal modes of operating facility systems should provide adequate protection of health and safety.	5 rem/yr 50 rem/yr any organ, skin, or extremity 15 rem/yr lens of eye 1.0 rem/yr ALARA design objective per 10 CFR 835.1002(b) (1)	5 rem/yr 1.0 rem/yr ALARA design objective per 10 CFR 835.1002(b) (1)	10 mrem/yr (airborne pathway) 100 mrem/yr (all sources) 100 mrem/yr (public in the controlled area) 25 mrem/yr (radioactive waste)
Anticipated Events: Events of moderate frequency that may occur once or more during the life of a facility (e.g., minor incidents and upsets).	10^{-2}<f10^{-1}	The facility should be capable of returning to operation without extensive corrective action or repair.	5 rem/event (2, 3) 1.0 rem/event design action threshold (4)	5 rem/event (2, 3) 1.0 rem/event design action threshold (4)	100 mrem/event (3)

Table 1-2 Radiological Exposure Standards Above Normal Background

Description	Estimated Frequency of Occurrence f (yr^{-1})	General Guidelines	Worker	Collocated Worker	Public
Unlikely Events: Events that are not expected, but may occur during the lifetime of a facility (e.g., more severe incidents).	$10^{-4}<f10^{-2}$	The facility should be capable of returning to operation following potentially extensive corrective action or repair, as necessary.	25 rem/event (2, 3)	25 rem/event (2, 3)	5 rem/event (3)
Extremely Unlikely Events: Events that are not expected to occur during the life of the facility but are postulated because their consequences would include the potential for the release of significant amounts of radioactive material.	$10^{-6}<f10^{-4}$	Facility damage may preclude returning to operation.	~~25~~ 100 rem/event (2, 3)	~~25~~ 100 rem/event (2, 3)	25 rem/event 5 rem/event target (3) 300 rem/event to thyroid
Location of Receptor			Within the Controlled Area Boundary	The most limiting location at or beyond the Controlled Area Boundary	The most limiting location along the near river bank/Hwy 240/ southern boundary

(1) In addition to meeting the listed design objective of 10 CFR 835.1002(b), the inhalation of radioactive material by workers and collocated workers under normal conditions is kept ALARA through the control of airborne radioactivity as described in 10 CFR 835.1002(c).

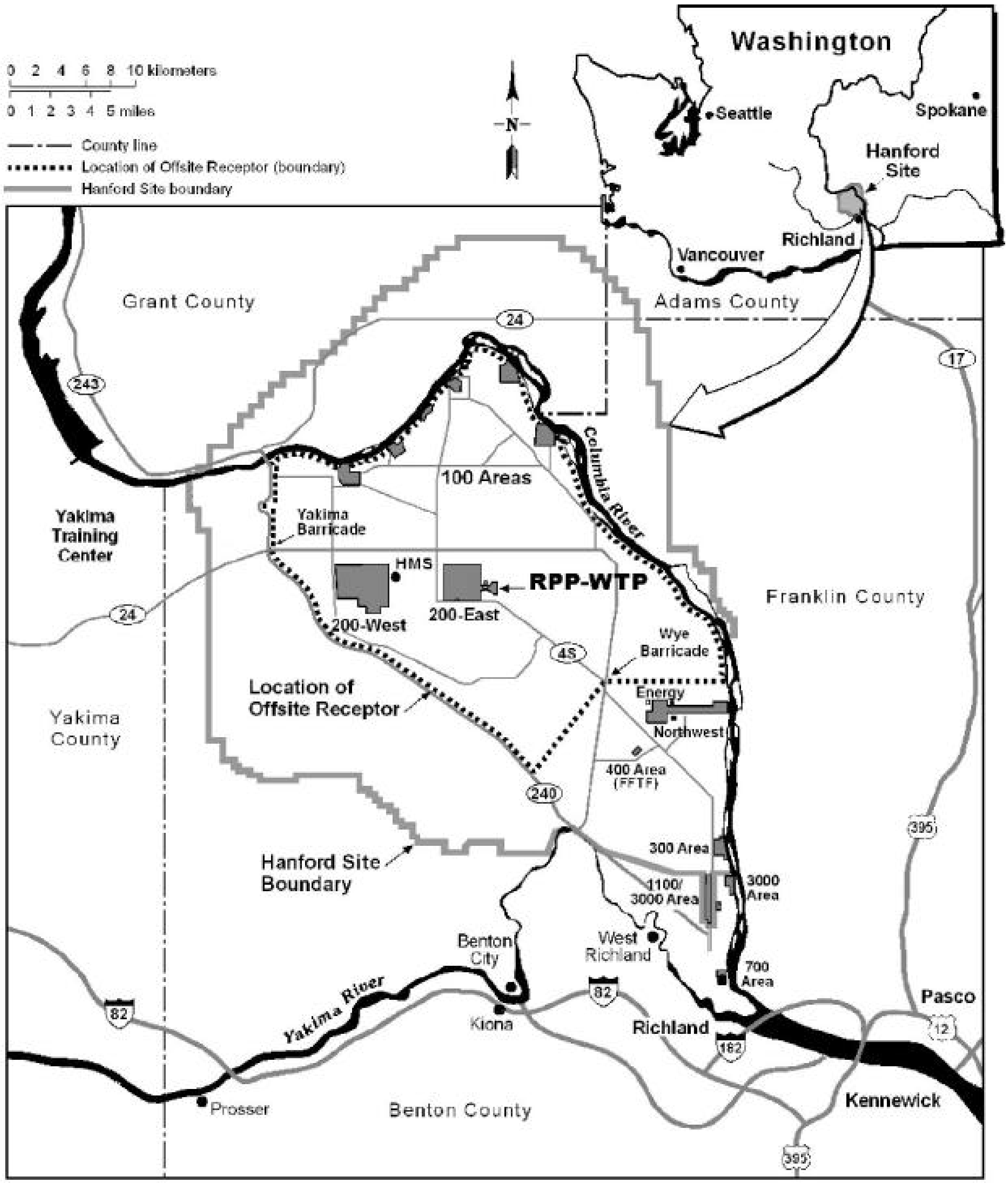
(2) In addition to meeting the listed worker and collocated worker exposure standards for accidents, the Worker Accident Risk Goal is satisfied through the calculation of the risk from accidents with accident prevention and mitigation features added as necessary to meet the goal.

(3) In addition to meeting the listed exposure standards for accidents, the Project approach to accident mitigation is to evaluate accident consequences to ensure that the calculated exposures are far enough below standards to account for uncertainties in the analysis and to provide for sufficient design margin and operational flexibility.

(4) When a calculated accident exposure exceeds this threshold, appropriate actions are taken. These include carrying out a less bounding (i.e., more realistic) evaluation to show that the accident consequences will be below the threshold or evaluating additional safeguards for cost effectiveness and/or feasibility. This threshold is not a limit; it does not require the implementation of additional preventative or mitigative features if they are not both cost effective and feasible.

A conservative approach is applied to accident consequence analysis in terms of input assumptions, boundary conditions, modeling techniques, and compliance with public radiological and chemical release standards. As the process and facility design mature, the analysis is refined to eliminate unnecessary conservatism that may have been applied solely to cover uncertainties in design. This strategy is consistent with a risk-based approach that allows the use of uncertainty analysis to better identify the impact of the assumptions and state of knowledge on results from the safety analysis.

Figure 1-2 Location of Public Receptor



1.3.8 Acceptable Level of Worker Safety

Radiological exposure standards applied to the ~~facility~~ workers (facility and collocated) ~~worker~~ are provided in Table 1-2. The location of the workers is shown in Figure 1-3. A 5 rem/event standard is applied to the workers for anticipated events, ~~and~~ a 25 rem/event exposure standard is applied to workers for unlikely events, and a 100 rem/event exposure standard is applied to workers for extremely unlikely events. The 25 rem/event standard corresponds to the once-in-a-lifetime accident or emergency exposure for radiation workers which, by recommendation of the National Committee on Radiation Protection (NCRP 1963), may be disregarded in the determination of their radiation exposure status. In addition, an exposure of 25 rem/event corresponds to a conditional probability of fatality of about 2×10^{-2}. For unlikely events (defined in Table 1-2 as having a maximum occurrence frequency of 10^{-2}/yr), this equates to a maximum increase in worker lifetime risk of premature death of about 2×10^{-4}/yr, which is less than the average of the accidental death risk for workers in some of the safest industries, such as retail and wholesale trade, manufacturing, and service (EPA 1991).

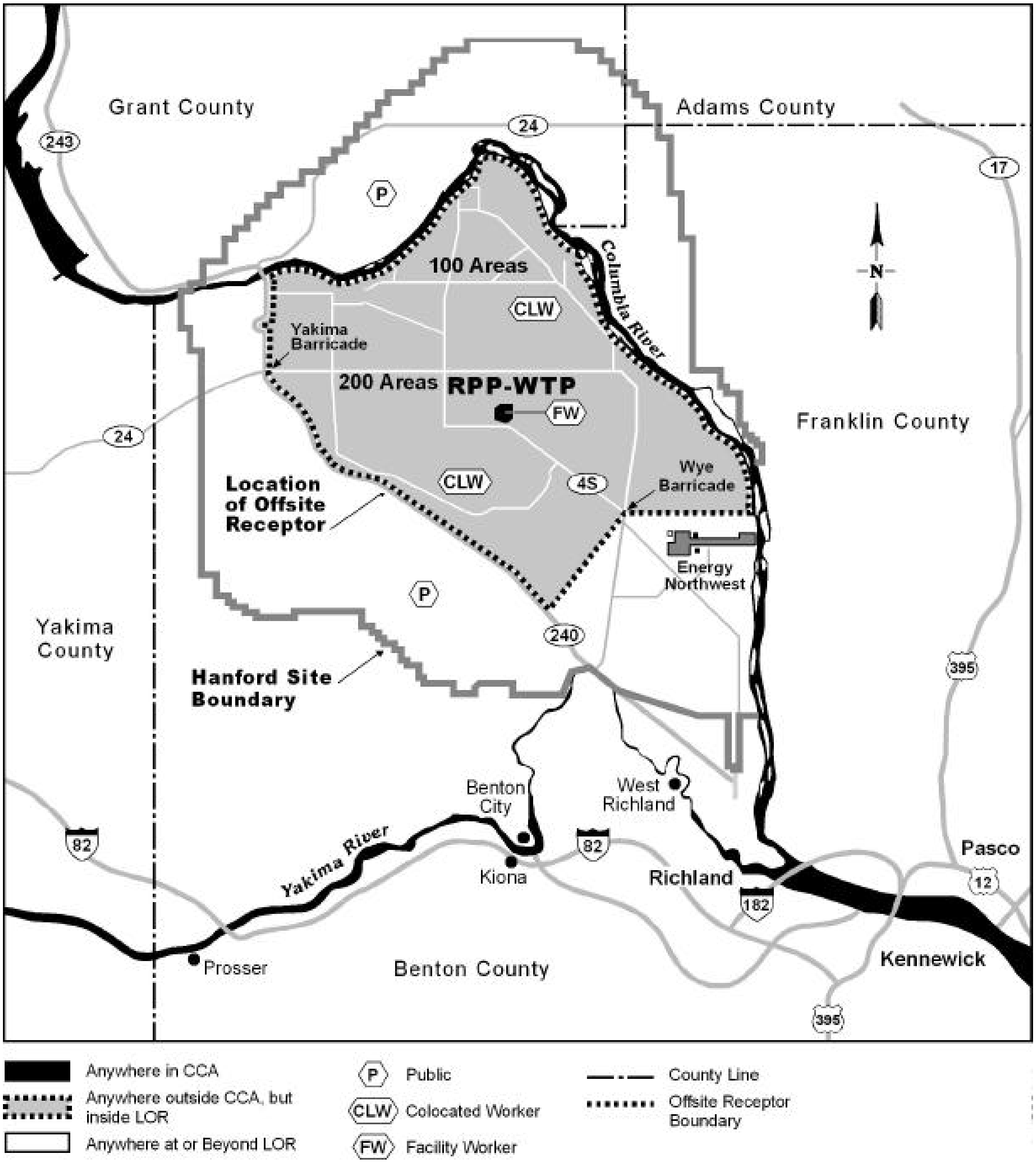
The 100 rem/event exposure standard for both the facility and collocated workers for extremely unlikely events is consistent with the worker exposure standard being employed elsewhere in the DOE complex including the Hanford Site. In addition, an acute radiation dose of approximately 100 rem carries almost no risk of a prompt death (DOE 1994a).

Compliance with ~~the 25 rem/event worker standard~~ these worker exposure standards is established using qualitative methods of the PHA supported, where necessary, by numerical analyses that may include the development of event trees and fault trees or the performance of consequence analyses. From this process, preventative and mitigative engineered and administrative controls to be added to the design are identified. The PHA identifies hazards and operability problems based on the design detail available and experience with similar facilities. Further hazard evaluation takes place in parallel with design development to ensure that safety is built into the design process. Having generated the list of hazards, this list is subject to a further systematic team-based review where a binning process takes place. The binning process is essentially the risk-based categorization of hazards and hazardous situations according to a frequency/consequence matrix.

The ~~25 rem/event~~ worker exposure standards for unlikely or extremely unlikely events ~~applies~~ apply to events with frequencies less than 10^{-2}/yr. For those frequencies, the PHA assigns serious and major hazardous situations as either undesirable, acceptable with controls, or acceptable. For a hazardous situation to be acceptable, the situation must have consequences less than ~~25 rem~~ the corresponding worker exposure standard. Where there is uncertainty concerning the appropriate hazard category to be assigned, the hazard is binned to the higher category to ensure that the accident analysis remains conservative.

For those accidents that involve a radionuclide release, the calculated exposures are compared to the radiological exposure standards of Table 1-2 to determine the need for accident prevention or mitigation features credited for worker safety. For chemical release, the projected exposure is compared to the standards in ERPG-2. If the analysis of radiological or chemical exposures do not confirm the adequacy safety, the need for engineered or administrative controls to prevent or limit the release is addressed. These features are designed and maintained to the highest applicable standards to ensure their functional performance in the prevention or mitigation of accidents. Features credited for satisfying the radiological exposure standards of Table 1-2 and chemical release exposure standards of ERPG-2 (AIHA 1988) are classified as Safety Design Class.

Figure 1-3 Location of Facility and Collocated Workers



The worker accident risk goal is stated in DOE/RL-96-0006 as, "The risk, to workers in the vicinity of the Contractor's facility, of fatality from radiological exposure that might result from an accident should not be a significant contribution to the overall occupation risk of fatality to workers" (DOE-RL 1996b, Section 3.1.3). This goal is satisfied by calculating the risk of facility operation to the workers at the WTP. This is a best-estimate analysis based on realistic input and modeling assumptions. In performing this analysis, all SSCs capable of preventing or mitigating the event are considered. The evaluation of the availability and reliability of the SSCs include factors such as failures to start and failures to operate, as well as unavailability resulting from maintenance activities. Accident prevention and mitigation controls are added to the design as necessary to satisfy the worker accident risk goal.

If credit is taken for operator action to satisfy the worker radiological exposure standards of Table 1-2, adequate radiation protection is provided to permit access and occupancy of the control room or other control locations under accident conditions without personnel receiving radiation exposures in excess of 5 rem total effective dose equivalent (TEDE), 30 rem thyroid, and 30 rem beta skin for the duration of the accident. In the event operator action is not required, other than immediate actions required to place the facility operation into a safe state, then the worker exposure standards of Table 1-2 apply. If credit is taken for operator action to satisfy worker chemical exposure to the standard specified in SRD Safety Criterion 2.0-2, provisions are made so that the operator exposure does not exceed the standard specified in SRD Safety Criterion 4.3-7.

Additional details on the radiological exposure standards applied to the public and workers are provided in Appendix D of 24590-WTP-SRD-ESH-01-001-02, *Safety Requirements Document Volume II*, which also provides information on the basis for the assumed location of the receptors.

1.3.9 Quality Assurance Program

The quality assurance program (QAP) is an important tool in achieving the goal of the safe operation of the WTP. The QAP defines the organizational structure, functional responsibilities, levels of authority, and interfaces for those managing, performing, and assessing the work to be performed. The Project developed its quality assurance program (QAP) in compliance with the requirements of 10 CFR 830.120, "Quality Assurance Requirements", so the integration of the QAP for the TWRS-P Project began during the initial phases of the project. The QAP document for Part A has been submitted to and approved by the U.S. Department of Energy (DOE) (Sheridan 1997). The QAP document for Part B activities has been submitted to DOE; this version (BNFL 1998c) has been approved by the DOE Regulatory Unit (Gibbs 2000). BNI revised the BNFL/CHG QAP document into a Quality Assurance Manual (QAM). This QAM (BNI 2001) superceded the CHG QAP document (i.e., BNFL-5193-ISP-01, Revision 8) in its entirety.

As a result of early development of the QAP, the PHA, SRD, and HAR were developed in accordance with the requirements in the QAP. The application of the requirements of the QAP continues during design, procurement, construction, commissioning, inspections, operations, maintenance, modifications, and deactivation of the facility. Administrative processes such as training, procedure development, and configuration management are subject to the requirements of the QAP. The QAP is used by the Project team to ensure that all aspects of the integrated safety approach have been implemented for the Project.

The WTP Project QAP document (i.e., BNFL-5193-QAP-01, Revision 8) was restructured to reflect BNI QA program policy, as well as use of NQA-1-1989 (ASME 1989), QARD (DOE 2000), and DOE O 414.1A (DOE 1999), as issued in a *Quality Assurance Manual* (BNI 2001). This QAM serves as the Authorization Basis document for implementation of the Project QA program. The QAP requires periodic assessments of activities, both by management and by knowledgeable, independent personnel, as described in QAM section 18. The conduct of audits to objectively evaluate the effectiveness and proper implementation of the QAM for activities affecting quality of SSCs and surveillances of specific project activities (e.g., process controls, preparation of safety documentation, configuration and document control, and records management) to supplement the compliance audit program are also described in the QAM. The QAM also describes the process of qualifying personnel who perform assessments, audits, and surveillances, as well as documentation of results and review by management.

Performance monitoring is used to verify that the necessary programs, plans, and procedures are functioning to ensure that activities are maintained in compliance with the applicable requirements. The findings of performance monitoring are used to determine if changes are needed to ensure that the high standards of performance expected are achieved.

The QAP ensures that identified corrective actions are implemented and any follow-up actions, such as the performance of a re-audit of a deficient condition, are conducted.

Different aspects of the implementation of the QAP are discussed in the following parts of the ISMP:

1) Chapter 2.0 “Compliance with Laws and Regulations”
2) Section 3.5 “Quality Assurance Program”
3) Section 5.4 “Compliance Audits”
4) Chapter 10.0 “Assessments”

1.3.10 Classification of Structures, Systems, and Components

The design classification process used on the Project provides a consistent, project-wide approach for the classification of the WTP SSCs based on their importance to controlling normal releases and accident prevention and mitigation. This approach ensures that SSCs are designed, constructed, fabricated, installed, tested, operated, and maintained to quality standards commensurate with the importance of the functions that need to be performed. As the facility moves to deactivation, and the safety functions change, the classification of SSCs will be revised as necessary.

The design classification system provides assurance to DOE that the defined safety functions of SSCs will perform as intended.

In this system, SSCs are designated as Important-to-Safety in accordance with the definition of this term as provided in *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors* (DOE-RL 1996b).

SSCs defined as Important-to-Safety for the WTP include the following.

1) SSCs needed to prevent or mitigate accidents that could exceed public or worker radiological and chemical exposure standards of Table 1-2 and SSCs needed to prevent criticality. This set of SSCs includes both the front line and support systems needed to meet these exposure standards or to prevent criticality. This set of Important-to-Safety SSCs are designated as Safety Design Class.
2) SSCs needed to achieve compliance with the radiological or chemical exposure standards for the public and workers during normal operation; and SSCs that place frequent demands on, or adversely affect the function of, Safety Design Class SSCs if they fail or malfunction. This set of Important-to-Safety SSCs are designated as Safety Design Significant.

The processes for identifying the SSCs for each of the two groups of SSCs Important-to-Safety and the requirements assigned to each of the two groups are discussed below.

Safety Design Class SSCs typically are identified by the results of accident analyses that show the potential for exposure standards to be exceeded. However, additional items also are designated Safety Design Class independent of a specific accident analysis. These are items that protect the facility worker from potentially serious events. Typically, these events are deemed to present a challenge to the facility worker severe enough that mitigation is prudent, without the need to perform a specific consequence analysis. These latter items are identified by the results of the HAR.

Safety Design Significant SSCs are identified in several ways including: (1) SSCs identified as significant contributors to safety by the risk analyses that confirm the facility accident risk goals are met (this is one way to identify SSCs that place frequent demands on, or adversely affect the function of, Safety Design Class SSCs if they fail or malfunction), (2) SSCs that are needed to ensure that standards for normal operation are not exceeded (e.g., bulk shield walls or radiation monitors), (3) SSCs selected based on the dictates of nuclear and chemical facility experience and prudent engineering practices, and (4) SSCs whose failure could prevent Safety Design Class SSCs from performing their safety function (e.g., Seismic II/I items).

SSCs identified in ISAR Section 4.8, "Controls for Prevention and Mitigation of Accidents" as Design Class I and II are Safety Design Class SSCs. SSCs provided to protect the health and safety of the public and collocated workers usually are considered to also provide adequate protection of the environment. As stated in ISAR Section 4.8, "The selection of engineered and administrative controls is based on the conceptual design of the facility. Additional or different features may be identified during Part B". The more complete group of Important-to-Safety SSCs will be identified in Part B and provided in the Preliminary Safety Analysis Report (PSAR) as part of the Construction Authorization Request. The PSAR and the Final Safety Analysis Report also will describe SSCs that are not designated as Important-to-Safety. The descriptions of these SSCs will note that they are not classified as Important-to-Safety.

When a SSC is designated as Safety Design Class it has the following attributes:

1) Quality Level 1 (QL-1) is applied to the SSC. The QAP describes the requirements associated with QL-1.
2) For an active system or component, the safety function is preserved by application of defense-in-depth such that failure of the system or component will not result in exceeding a public or worker accident exposure standard. For a mitigating feature, this means that, given that the accident has occurred, the consequence of the accident will not result in exceeding a public or worker exposure standard. For a preventative feature, this means that the failure of the system or component will not allow the accident to

occur and progress such that a public or worker accident exposure standard is exceeded. This requirement may be achieved by designing the Safety Design Class system or component to withstand a single active failure or by designating two separate and independent systems or components as Safety Design Class.

3) The SSC is designed to withstand the effects of natural phenomena such that it can perform any safety functions required as a result of a natural phenomena event. For example, if an earthquake can produce exposures to the public or workers in excess of standards, the Safety Design Class SSC that prevents or mitigates the exposures would be designed to be DBE-resistant and designated as Seismic Category I for radiological hazards (or Seismic Category III for chemical hazards). However, DBE-resistance is not applied automatically to Safety Design Class SSCs. It is applied only when the earthquake is the initiating event, or when the earthquake could cause the initiating event. A Safety Design Class SSC that does not have a DBE mitigating function is designated as Seismic Category III.

   This natural phenomenon hazard (NPH) design philosophy is used for all severe natural phenomena events (i.e., earthquake, flood, high wind). Therefore, if a Safety Design Class SSC is needed for meeting public or worker exposure standards for a given NPH event, the NPH loads associated with that event are taken from SRD Volume II, Table 4-1, “Natural Phenomena Design Loads for Important-to-Safety SSCs with NPH Safety Functions”. All other NPH loads for the Safety Design Class SSC may be taken from SRD Volume II, Table 4-2, “Natural Phenomena Design Loads for SSCs without NPH Safety Functions” in lieu of SRD Table 4-1.

4) General design requirements are applied as identified in Section 4.0 of the SRD for Safety Design Class SSCs. See SRD Safety Criterion 4.1-5 as an example.

5) Specific design requirements based on the type of component are applied as invoked in SRD Chapter 4.0. For example, SRD Safety Criterion 4.4-5 provides requirements associated with Safety Design Class air treatment systems.

6) Other design requirements may be applied based on the specific safety function to be performed by the Safety Design Class SSC. This specific safety function is determined from the accident analysis that identified the need for prevention or mitigation by Safety Design Class SSCs.

7) Operational requirements (e.g., periodic testing and preventative maintenance) are applied to Safety Design Class SSCs through the application of Technical Safety Requirements (discussed in ISMP Section 4.2.3.4 “Technical Safety Requirements”).

When a SSC is classified as Safety Design Significant it is has the following attributes.

1) Quality Level 2 (QL-2) is applied to the SSC. The QAP describes the requirements associated with QL-2.

2) The SSC is designed to withstand the effects of natural phenomena such that it can perform its safety functions required as a result of a natural phenomena event. If an earthquake can produce exposures to the public or workers in excess of standards, the Safety Design Class SSC that prevents or mitigates the exposures would be designed DBE-resistant as discussed above. The same NPH loads also are applied to a Safety Design Significant SSC if failure of the item could prevent the Safety Design Class SSC from performing its safety function required as a result of the DBE. Such an SSC is designated Seismic Category II. It should be noted, however, that DBE resistance is not automatically applied to Safety Design Significant SSCs. It is applied only when the earthquake is the initiating event, or when the earthquake could cause the initiating event. A Safety Design Significant SSC that does not have a DBE mitigating function is designated Seismic Category III.

This NPH design philosophy is used for all severe natural phenomena events (i.e., earthquake, flood, high wind). Therefore, if a Safety Design Significant SSC is needed to meet public or worker exposure standards for a given NPH event, the NPH loads associated with that event are taken from SRD Volume II, Table 4-1, "Natural Phenomena Design Loads for Important-to-Safety SSCs with NPH Safety Functions". All other NPH loads for the Safety Design Significant SSC may be taken from SRD Volume II, Table 4-2, "Natural Phenomena Design Loads for SSCs without NPH Safety Functions" in lieu of SRD Table 4-1.

3) General and specific design requirements are applied as identified in Section 4.0 of the SRD for Safety Design Significant SSCs.
4) Other design requirements again may be applied based on the specific safety function to be performed by the Safety Design Significant SSC.

1.3.11 Quality Levels

The assignment of Quality Levels (QL) is the method by which the implementation of the graded quality approach discussed in 10 CFR 830.120, "Quality Assurance Requirements" is ensured. Designation of correct quality levels helps to ensure that the appropriate quality assurance requirements are applied to specific WTP SSCs. The quality levels of the Project quality assurance approach and their applications are described in the QAP.

1.3.12 Training

Training serves an important role in the Project by ensuring that the personnel involved with the project have sufficient knowledge to safely fulfill the roles and responsibilities of their assigned tasks. Training has a direct impact on safety during design, construction, operation, and deactivation of the project by:

1) Improving technical ability
2) Enhancing personal skills
3) Increasing awareness of signs of potential hazardous situations in the workplace
4) Increasing personal awareness of the potential impact of actions taken with regard to the safety of the individual, others, and the facility
5) Establishing a safety culture that clearly assigns the responsibility for safety to the individual

During the design and construction phases of the project, the training focus is on the requirements such as design evolution, compliance with regulations and commitments, construction activities, and quality assurance.

Operator training and qualification is of specific importance in the training program. The operator training program is enhanced by the experience of the Project team at other similar facilities and by the information made available during the design phase and the commissioning program. In addition, operation of the demonstration plants provides invaluable training opportunities for the facility operators.

In recognition that different training is required for different assignments, the training plan addresses the assessment of training requirements and responsibilities and the evolution of the training plan required as the project matures. Additional information on training is provided in ISMP Section 3.15 "Training and

Qualification" and Section 4.2.2, "Training and Procedures". The training plan is described in ISAR Section 3.4, "Training and Qualification".

1.3.13 Procedures

Procedures are one tool by which compliance with requirements is ensured during the design, construction, operation, and deactivation of the project. All activities that may affect safety of the public and workers are performed in accordance with step-by-step instruction provided in procedures. The range of activities covered in procedures includes, but is not limited to:

1) Design control
2) Procurement activities
3) Monitoring contractors
4) Identification and resolution of nonconforming conditions
5) Operations and maintenance
6) Emergency plan implementing procedures

There is a defined hierarchy of procedures commensurate with the philosophy used to developed the tailored levels of design classification and quality levels. For example, procedures supporting the implementation of Technical Safety Requirements that are credited for accident prevention or mitigation will have a greater safety significance than procedures supporting maintenance activities on other SSCs. Those procedures, at the highest level, are subject to increased rigor with respect to their development, review, implementation, and change. Increased rigor includes requirements for independent review and approval by qualified and experienced personnel or safety committees. Training emphasizes the importance of the hierarchy as well as the content of the procedures and the requirement to follow procedures to ensure safe and efficient activities.

One category of procedures is the operating procedures. These procedures are developed during the design and construction phase, when more detailed design information is available. The design information, test data, and design requirements are incorporated into the operating procedures. The operating procedures address normal and off-normal facility conditions, process startup and shutdown, and emergency events. The development and control of the operating procedures are summarized in ISMP Section 5.6.1, "Procedure Development", and is addressed in ISAR Section 3.9, "Procedures".

1.3.14 Commissioning

Another integral portion of the safety approach is the commitment to a thorough startup testing program. The program validates that the design, construction, hardware, programs, and personnel are ready to support the safe operation of the facility. The tests performed ensure that the equipment and facility are properly built and will operate as designed prior to transition to the operational phase. In addition, the startup testing program documents the as-built configuration and the initial operating parameters of the facility. The program serves as an opportunity to perform a final system analysis and to detect significant faults prior to facility operation. The startup testing program is also used to confirm the adequacy of training and procedures to be used for facility operation.

The method of testing used in the startup testing program can require analysis, demonstration, examination, inspection, or functional test. The selection of the appropriate test method and scope of the tests are determined using a systematic analysis and are described in ISAR Chapter 3.0, "Conduct of Operations". In general, the startup testing program is a phased program, with successful individual component testing leading to system functional and interface testing, followed by the integrated system testing. A final phase of the program, testing with design waste feed materials, must be successful completed before the facility transitions to an operational phase. Additional information is provided in ISMP Section 3.14, "Commissioning and Operation" and Section 5.6.4, "Commissioning Review".

1.3.15 Operations

The Project safety approach, which began with the design phase and is followed through the construction and testing phases, is also emphasized in the operational phase by establishing a set of principles for achieving excellence in operation of the WTP. This set of principles is implemented as a Conduct of Operations program (see ISAR Section 3.11, "Operational Practices") that controls and conducts the operations of the facility. Attributes of the program include the following.

1) Operation of the facility in accordance with the Technical Safety Requirements
2) The establishment of high standards
3) The communication of those standards to the workforce
4) Provisions for the sufficient number of qualified personnel required to perform the activities necessary to meet the standards
5) Implementation of a philosophy to hold workers and managers accountable for their performance

The conduct of operations program practices are major contributors to the safety of the public and workers. The practices are summarized in the ISAR Chapter 3.0, "Conduct of Operations", and detailed guidance on the practices will be incorporated in the WTP procedures. The conduct of operations program includes shift routines and operational practices (e.g., operator inspection tours, log keeping, response to indications, and resetting protective devices), control area activities (e.g., communications and on-shift training), control of equipment status, lockouts and tagouts, independent verification, operations turnover, required reading, operations procedures, operator aid postings, equipment and piping labels, and incident investigation and reporting.

Another key element in the safety approach is the involvement of operations personnel throughout the design process and the involvement of the design personnel through turnover of the facility to the operations staff (see ISAR Section 3.10.1, "Testing Program Description"). This involvement allows operations personnel not only to provide input to the design process to develop a safe and operable facility, but also to become knowledgeable in the features and limitations of systems and components of the facility. Additionally, the development of facility control system simulators in advance of facility testing strengthens the ability and confidence in the performance of the systems and the operational interfaces. The simulators provide an important integration of the design and operating personnel during the testing in further support of a smooth transition to the operational phase of the project. This interface between the designers, the operators, and the simulators ensures the ability of the Project team to demonstrate operational readiness in advance of final testing activities of the facility.

1.3.16 Configuration Management

Configuration management is one of the fundamental principles to achieve safety. Throughout the life cycle of the RPP-WTP, configuration management is applied to all activities to ensure that programmatic objectives related to radiological, nuclear, and process safety are achieved. Work is performed and controlled to pre-approved plans and procedures that delineate responsibilities. Records that define the requirements, design, verification, and acceptance of the WTP are retained to provide an accurate record of the design including approved changes to the design. Operating organizations define operational requirements and participate in design review, procedure preparation, training, and planning activities to become familiar with the features and limitations of components included in the design of the facility. Organizations that manage or interface with subcontractors or suppliers of items, activities, or services involving configured items flow down applicable requirements to ensure that the configuration management process as defined in the *RPP-WTP Configuration Management Plan* (CM Plan) (BNI 2001f) are properly implemented.

The WTP Configuration Management Program provides direction to identify and document the physical and functional characteristics of facility structure, systems, components, and computer software applications. Its application to design, construction, commissioning, operations, and deactivation activities ensures proposed changes to these characteristics are properly developed, approved, implemented, verified, and incorporated into facility design documentation. The CM Plan is based upon ISO 10007:1995(E), *Quality Management - Guidelines for Configuration Management*.

The project formally identifies and establishes configuration baselines, systematically evaluates and dispositions changes, and records the implementation of approved changes. The Configuration Management Program establishes the policies, guidelines, and responsibilities serving to ensure that:

- The engineered configuration of the project is controlled to ensure it meets design, performance, and acceptance requirements.
- Approved configuration changes are assessed for their impact on performance and safety.
- The configuration status of the technical baseline is maintained.

Configuration management is implemented through project plans and procedures that incorporate requirements from the CM Plan and other top-level requirements documents. Records including Authorization Basis documents; engineering and other source requirements documents; design documents; identification of structures, systems, and components; and links between the design documents and the requirements documents are maintained in an electronic data management system managed by Project Document Control.

Effective implementation of configuration management and supporting processes is assessed through management self-assessments in accordance with approved project procedures. Additionally, formal audits performed by Quality Assurance to their normal auditing practices verify compliance with approved project procedures.

1.3.16.1 Configuration Management Approach

The WTP configuration management program implements a process consisting of four basic steps, as follows:

1) **Identification and documentation.** The activities comprising selection of configured items, documenting their physical and functional characteristics, and allocating unique identification characters and numbers to the configured items and their configuration documents.
2) **Change control.** The activities comprising the control of changes to a configured item after formal issue of its configuration documents.

3) **Status tracking and reporting.** Formal recording and reporting of configuration documents, and the approved changes to those documents.
4) **Configuration audit.** Examination of review, inspection, and test records to determine that a configured item conforms to its configuration documents.

Project plans and procedures fully implement the configuration management process by delineating responsibilities for organizations that manage activities and provide services related to configuration management. Implementing procedures are cited in the CM Plan (BNI 2001f).

1.3.16.2 Configured Item Identification and Documentation

Configured items are selected and documented taking into consideration at what level functional and physical characteristics can be best managed to achieve the overall WTP Project performance objectives related to radiological, nuclear, and process safety. Items identified for configuration management include structures, systems, and components; plant installed software; project interfaces; and Authorization Basis documents.

1.3.16.3 Change Control

Design configuration is controlled in accordance with approved project procedures to maintain an accurate record of the design. Changes are documented to describe the change, the reason for the change, and to identify the configured item and related documents to be changed.

Change control is a formal process comprised of change documentation, evaluation, approval, and implementation.

1.3.16.3.1 Documentation

Changes must be documented except for insignificant changes, i.e., those with no affect on safety, environmental protection, the Authorization Basis, scope, schedule, or cost. When the change control process uses separate change documents, the change documents shall have unique identification numbers for status tracking and convenient to establish links to affected or related documents in the electronic data management system.

1.3.16.3.2 Evaluation

Engineering evaluates proposed changes to identify interface or discipline subject matter impacts and to establish that a proposed change should be implemented. Factors to be considered in the evaluation include compliance of the change with regulations, the Authorization Basis, applicable codes and standards, and safety and environmental significance. Environmental, Safety, and Health monitors the impact evaluation process.

1.3.16.3.3 Approval

The approval process for changes is commensurate, in detail and approval authorities, with the approval process for the original configuration. This may include obtaining authorization from the PSC, customer, or regulators prior to implementing the change.

1.3.16.3.4 Implementation

Approved changes are implemented in accordance with WTP Project procedures identified in the CM Plan specific to the various configured item types encountered in design, procurement, construction, commissioning, operations, and deactivation activities.

1.3.16.4 Status Tracking and Reporting

Status tracking and reporting consists of recording and reporting information required to manage and administer the configuration management process and related activities. Information is recorded, links to related documents entered, and sorted for reporting in the electronic data management system managed by Project Document Control.

1.3.16.5 Configuration Audits

Configuration audit is the examination of items and documents to determine whether a configured items conforms to its configuration documents. Configuration audit typically consists of functional and physical confirmation.

Functional confirmation is accomplished by identifying the individual functional and performance requirements of a configured item and confirming through review, inspection, and test records that the requirements are achieved.

Physical confirmation is accomplished by examining the physical or as-built and tested configured item for compliance to its configuration documents. Together, the functional confirmation and the physical confirmation demonstrate that the configured item, as defined by its configuration documents, conforms to the physical and functional requirements.

1.3.16.6 Functions and Requirements Management

The Contract, *Basis of Design*, *Functional Specification*, *Operational Requirements Document*, and Authorization Basis design requirements are compiled in an Access © database, designated the Design Criteria Database (DCD). The database has full text and keyword search capabilities. This database is used by design and safety personnel to identify applicable safety functions and requirements for use in the WTP design. The database is updated by procedure each time a source document is revised.

The configuration management organization maintains the *Basis of Design* and DCD to integrate design requirements, safety standards, and operational requirements.

1.3.16.7 Training

The configuration management organization develops, maintains, and provides training on the configuration management program for the project. This training includes a description of the program, reasons why the program is used, the elements of configuration management, and how the program is implemented on the project. This training is provided to employees as part of the Safety and Quality Design Required Training.

1.3.17 Incident Investigations

The importance of the identification and correction of nonconforming conditions as part of a safety approach for the Project is recognized. To ensure that significant incidents that could adversely affect the quality, security, environment, operations, or health and safety of public and workers are brought to the attention of management, the project regulator, and the DOE Occurrence Reporting and Processing System, the ISMP requires incident investigation and reporting. The incident investigations for the Project are expanded in scope to include accidental radionuclide releases and the construction and startup testing phases of the project. Also, reporting of events of less severity than those required of process safety management are included in the program. Incidents to be reported to the regulator include, for example, events or conditions at the facility that resulted in degradation of the principal safety barriers or in a condition beyond the design basis or emergency procedures. The incident investigation process requires that serious events or conditions are addressed and resolved and that the findings of the investigation are resolved.

The investigations are conducted in accordance with the Safety Criteria in SRD Volume II, Section 7.7, "Reporting and Incident Investigation". Additional detail on the implementing procedures are contained in ISAR Section 3.7, "Incident Investigations".

1.3.18 Emergency Planning

An important aspect of the safety approach is to ensure the health and safety of the public and the workers during emergency situations at the WTP. This is accomplished through the development of an emergency management plan for the prompt, efficient, and effective response to emergencies in accordance with the applicable local, state, and federal regulations. The development and the implementation of the emergency management plan are enhanced by the involvement of BNI with the existing Hanford emergency management community. The emergency management plan is fully implemented before radioactive wastes or hazardous chemicals are introduced into the facility. The construction manager implements state and federal emergency preparedness requirements for hazardous situations that may arise during construction.

The scope of the emergency management plan will be determined following the final assessment of the hazards and hazardous situations to be completed during Part B. The implementing procedures will ensure compliance with the applicable requirements that are identified during the development of the emergency management plan. Additional information is included in ISMP Section 3.10, "Emergency Preparedness" and is presented in ISAR Chapter 9.0, "Emergency Management.

1.3.19 Deactivation

All of the previously discussed elements of the WTP safety approach are applied to the deactivation phase of the project.

In addition, the WTP incorporates design provisions to facilitate deactivation and final decommissioning. These provisions reduce radiation exposure to Hanford Site personnel and the public during and following deactivation and decommissioning activities and minimize the quantity of radioactive waste generated during deactivation.

A deactivation plan is prepared prior to construction of the WTP. The deactivation plan provides details on how the following activities will be accomplished to achieve a deactivated status for the facility.

1) Verification of the completion of the facility deactivation end point. (The term facility deactivation end point refers to the set of conditions that comprise the completion of facility deactivation [i.e., radiological, structural, equipment, and documentation])
2) Documentation of the regulatory status, conditions, and inventories of remaining radioactive and hazardous materials and health and safety requirements
3) Modification of the facilities, structures, support systems, and surveillance systems to provide for confinement and monitoring of the remaining contamination, radiation, and other potential hazards
4) Posting and securing of the facility
5) Removal of packaged special nuclear materials and other packaged radiological and chemical materials
6) Confirmation that security systems and procedures are adequate and in place to prevent unauthorized entry

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Summary of ISM Process for Revision to Implementing Standards and Safety Criteria

1 Purpose

This attachment summarizes and documents the Integrated Safety Management (ISM) process associated with the safety assessment of proposed changes incorporated within this Authorization Basis Change Notice (ABCN).

2 Scope

This attachment is a summary of the ISM process results that resulted in the development of proposed changes incorporated in this ABCN. The change proposed in this ISM process is the revision of the radiological exposure standard (RES) table for extremely unlikely events. Attachments 1 and 2 of this ABCN document the actual proposed changes (in underline/strikeout format) to 24590-WTP-SRD-ESH-01-001-02, *Safety Requirements Document* (SRD) and 24590-WTP-ISMP-ESH-01-001, *Integrated Safety Management Plan* (ISMP).

3 Discussion

3.1 Approach

The identification of the proposed changes to the SRD and ISMP were performed in compliance with project procedure 24590-WTP-GPP-SANA-002, *Hazard Analysis, Development of Hazard Control Strategies, and Identification of Standards*. 24590-WTP-GPP-SANA-002 implements SRD Appendix A and DOE/RL-96-0004, *Process for Establishing a Set of Radiological, Nuclear, and Process Safety Standards, and Requirements for the RPP Waste Treatment Plant Contractor.*

The procedure consists of the following major process elements:

- Initiate process
- Identify work
- Hazard evaluation
- Development of preferred hazard control strategies
- Design basis events (DBEs)
- Designation of systems, structures, and components (SSCs) comprising the hazard control strategy
- Identification of standards
- Confirmation of standards
- Record document identification
- Documentation

These are discussed in more detail below.

3.2 Results

3.2.1 Initiation of Process (ISM Team Composition)

Project procedure 24590-WTP-GPP-SANA-002, section 3.10, Identification of Standards states: "Identification of other standards (e.g., standards for quality assurance, conduct of operations, etc.) will be performed by specially constituted teams formed by the [Process Management Team] PMT in support of the [Preliminary Safety Analysis Report] PSAR."

A multi-discipline ISM team was specially constituted by the PMT to determine potential changes to the RES table. The need to establish this team, the selection of an appropriate chairperson, and the type of project disciplines needed was established at the PMT meeting held on July 7, 2002 and clarified on July 24, 2002. The team lead selected knowledgeable individuals for each required discipline that were current on the list of qualified individuals (LQI). The team lead also utilized subject matter experts.

Because the potential changes to the RES table do not affect engineering/design, manufacture/fabrication, or construction standards the ISM team excluded specific work activity experts, hazard assessment experts, hazard control experts, or standards experts who would typically be assigned to an ISM team.

The table below lists the team members. Additional input on the basis and history of the radiological exposure standards was solicited from Rich Smith, the Bechtel National, Inc. (BNI) Principal Nuclear Engineer, who is also on the LQI.

Name	Title/Qualification	Department	Team Role
Lee Dougherty	Safety and Licensing Engineer / LQI	ES&H/Regulatory Safety	Lead/Chairman appointed by PMT
Cindy Beaumier	HLW Operations Lead / LQI	Commissioning and Training/Area Operations	Operations representation required by PMT
Gary Kloster	Technical Baseline Manager /LQI	Engineering/Technical Baseline	Engineering representation required by PMT
Robert Harshberger	Electrical Engineer / LQI	Engineering/Electrical	SME on WTP electrical system/diesel generator trains
Jay Lavender	HSA Lead / LQI	ES&H/ Safety Analysis	SME on DBE calculations
Andy Larson	Nuclear/Safety Design Engineering Specialist / past WTP experience – not LQI	Bechtel Hanford	SME on defense in depth requirements

3.3 Identify Work

The purpose of the identification of work element of the ISM process as intended by the process described in 24590-WTP-GPP-SANA-002 is that hazards and hazardous situations inherent in the work can be identified and evaluated.

Proposed changes only apply to a standard in the SRD that is administrative and does not involve engineering/design, manufacture/fabrication, or construction standards nor those that directly affect the process, hazards, or control strategies. Hazards and hazardous situations are also not applicable; therefore, control strategies with standards are unnecessary.

The result of this process step is that no "work" was identified. The procedure elements addressing hazard evaluation, development of preferred hazard control strategies, DBEs, and designation of SSCs comprising the hazard control strategy are not required. The process should continue with identification of standards.

3.4 Hazard Evaluation

Not required. See justification in section 3.3.

3.5 Development of Preferred Hazard Control Strategies

Not required. See justification in section 3.3.

3.6 Design Basis Events

Not required. See justification in section 3.3.

3.7 Designation of Systems, Structures, and Components Comprising the Hazard Control Strategy

Not required. See justification in section 3.3.

3.8 Identification of Standards

The standards identification activity required by DOE/RL-96-0004 was used to identify a tailored set of standards and requirements that will assure adequate safety when implemented. The implementing standards selection criteria:

- Provide adequate safety
- Comply with applicable laws and regulations
- Conform with top-level safety standards and principles

3.8.1 Review RES Table

The objective of the ISM team was to determine if improvements in the criteria for the RES table are needed. The requirement to meet the RES table is defined by SRD Safety Criterion (SC) 2.0-1. The regulatory basis for this table is section 2.1 of DOE/RL-96-0006, *Top-level Radiological, Nuclear, and Process Safety Standards and Principles for the RPP Waste Treatment Plant Contractor*; however, section 2.1 allows the contractor to select and justify certain exposure values cited in the RES table. These values were set very conservatively in order to ensure the facility risk goals are met; however, design evolution and ISM iteration have identified that there may be overly conservative design requirements as a result of the conservative values selected in the RES table.

The goal of the ISM team was to evaluate the process with respect to these issues and determine enhancements can be made that result in improved project life cycle cost-effectiveness while maintaining an adequate safety basis.

3.8.1.1 Relevant Requirements for the WTP

The requirement to meet the criteria of the RES table is defined by SRD SC 2.0-1. The regulatory basis for this table is section 2.1 of DOE/RL-96-0006. However, section 2.1, Table 1, "Dose Standards Above Normal Background", has several areas where the dose limits are "to be derived". This is footnoted with the following:

> "Specific limits were derived and proposed by the Contractor during Part A (≤ 25 rem/event). The specific derived value is subject to modification through the authorization basis change process described in RL/REG-97-13, *Regulatory Unit Position on Contractor-Initiated Changes to the Authorization Basi*s."

3.8.1.2 Current Approach to Meeting WTP Requirements

The values previously derived for use in the RES table were set very conservatively to ensure that the facility risk goals were met.

3.8.1.3 Challenges Associated with the Current Approach

Design evolution and ISM process iteration have identified that overly conservative design requirements may be a result of the values derived in the RES table.

3.8.1.4 Alternative Approach Based on "Top Down – First Principle" Assessment of Requirements

In SC 2.0-1 of the SRD, the RES table criteria for facility and co-located workers for events in the extremely unlikely event frequency range (10^{-4} to 10^{-6} per year) is 25 rem/event. The prior WTP contractor as required by Table 1 of DOE/RL-96-0006 derived this 25 rem limit. The current revision of DOE/RL-96-0006 recognizes, in a footnote to Table 1, the origin of the 25 rem standard and notes that this value is subject to modification through the ABCN process implemented in conformance with RL/REG-97-13.

In the alternative approach, 100 rem/event is established as the RES table limit for facility and co-located workers for events in the extremely unlikely event frequency range. This is acceptable based on the following:

1. The alternative approach is consistent with the approach employed elsewhere in the DOE complex including the safety criteria established for the Hanford Site by DOE in their letter to Fluor Hanford, Inc. (Klein 2002). The alternative WTP co-located worker standard of 100 rem is the same as the Hanford Site safety criteria. The alternative WTP facility worker standard (also 100 rem) is conservative with respect to the prompt fatality condition in the Hanford Site safety criteria.

2. The use of a 100 rem standard does not compromise worker safety. Throughout the DOE complex, there is no indication that workers are at risk, nor are accidents occurring that produce worker doses in this range (i.e., 25 to 100 rem).

3. The WTP risk goals are maintained. There are few events with dose-frequency outcomes in the alternative approach range. Under the current approach, additional controls would be in place for such events regardless of whether they are needed to meet risk goals. Under the alternative approach, the safety strategy is more focused, that is, additional controls are put in place only if the risk goals cannot be met.

4. DOE RL/REG-97-09, G*uidance for Review of TWRS Privatization Contractor Radiation Exposure Standards for Workers,* supports the use of a dose standard up to 100 rem for the extremely unlikely events, noting that "an acute radiation dose of approximately 100 rem carries almost no risk of prompt death."

3.8.1.5 Adequate Safety

Proposed changes to the authorization bases are acceptable if they maintain adequate safety. The revised derived values in the RES table are not significant to the overall risk of the workers as discussed above. The continued use of engineered safety features and administrative controls to ensure high consequence events remain at an extremely low frequency will continue to ensure an adequate safety basis for the WTP.

Compliance with Applicable Laws and Regulations

The proposed changes are acceptable, as they do not impact commitments made relative to laws and regulations (e.g., commitments made to 10 CFR 820, 830 and 835 are not impacted).

Conformance to Top-Level Safety Standards

The proposed changes are acceptable, as they are consistent with DOE/RL-96-0006, which states: "The risk, to workers in the vicinity of the contractor's facility, of fatality from radiological exposure that might result from an accident should not be a significant contributor to the overall occupational risk of fatality to workers". Table 1 from the top-level standards requires the contractor derive certain values and allows the contractor to change these values through the ABCN process developed in conformance with RL/REG-97-13.

Evaluation Against Applicable SRD Safety Criteria

The proposed changes are acceptable as they tailor existing SRD safety criteria for potentially excessive design conservatism. This change remains consistent with other SRD safety criteria.

3.8.1.6 Implementation Plan for Alternative Approach

Implementation of this proposed approach has been evaluated for impacts to the project. Implementation will support the existing project schedules while maintaining a safe approach. The new approach will satisfy the top-level DOE requirements and will not require any changes to the contract.

Changes to project documentation describing the potential Safety Criteria changes will be required, including revisions to the SRD, ISMP and the PSAR General Information volume. Likewise, the supporting procedures that implement the RES table criteria and the severity level accident analysis calculations that support the ISM process may require revision as well.

After the RES table has been revised, a review of the design and equipment will be performed to determine if changes to the design need to be made. It is anticipated that design requirements for some SSCs may be relaxed.

3.9 Confirmation of Standards

Based on the results of the ISM process, the PMT recommended the selected proposed revisions to the standards and Safety Criterion to the Project Safety Committee (PSC) Chair at the August 22, 2002 PMT meeting. The PSC Chair requested the PSC confirm that the proposed revised set of standards remain acceptable. The confirmation review approach is to distribute the ABCN for PSC review, present the approved ABCN at a PSC meeting, and reach consensus on approval of the ABCN. Resolution of comments by the PSC on the standards identification are required to be documented; however, no formal comments (PSC actions) were cited in the PSC meeting on August 28, 2002.

3.10 Record Document Identification

Project records required to document this ISM process are the relative PMT and PSC meeting minutes and the ABCN. Completion of the task is documented in PMT and PSC meeting minutes dated August 22, 2002 and August 28, 2002, respectively, and by PSC Chair signature on the ABCN.

3.11 Documentation

Following approval of the ABCN by the DOE Office of Safety Regulation, the results of the standards selection ISM process will be documented in the applicable sections of the SRD as indicated in the underline strikeout text in attachment 1 to this ABCN.

4 Conclusions

In summary, the recommended approach provides project benefits while maintaining a safe facility that meets all of the DOE top-level requirements. The following specific advantages exist for using this approach:

- WTP worker exposure standards will be more consistent with those used elsewhere in the DOE complex including the Hanford Site.
- Potential exists for cost savings without compromising the safety of workers.

5 References

Project Documents

24590-WTP-GPP-SANA-002, *Hazard Analysis, Development of Hazard Control Strategies, and Identification of Standards*

24590-WTP-ISMP-ESH-01-001, *Integrated Safety Management Plan*

24590-WTP-PSAR-ESH-01-002, *Preliminary Safety Analysis Report to Support Construction Authorization*

24590-WTP-SRD-ESH-01-001-02, *Safety Requirements Document*

Codes and Standards

10 CFR 820. "Procedural Rules for DOE Nuclear Activities," *Code of Federal Regulation*s, as amended.

10 CFR 830. "Nuclear Safety Management," *Code of Federal Regulation*s, as amended.

10 CFR 835. "Occupational Radiation Protection," *Code of Federal Regulation*s, as amended.

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